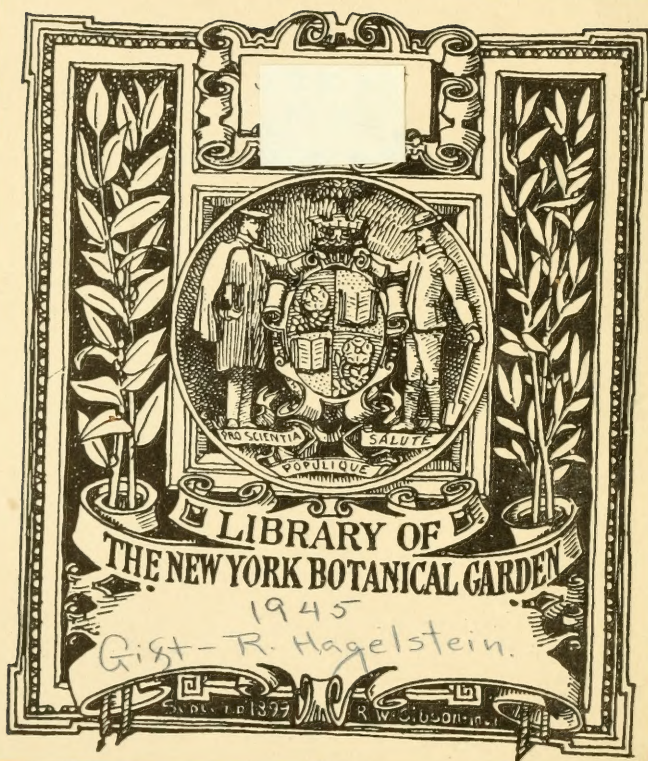




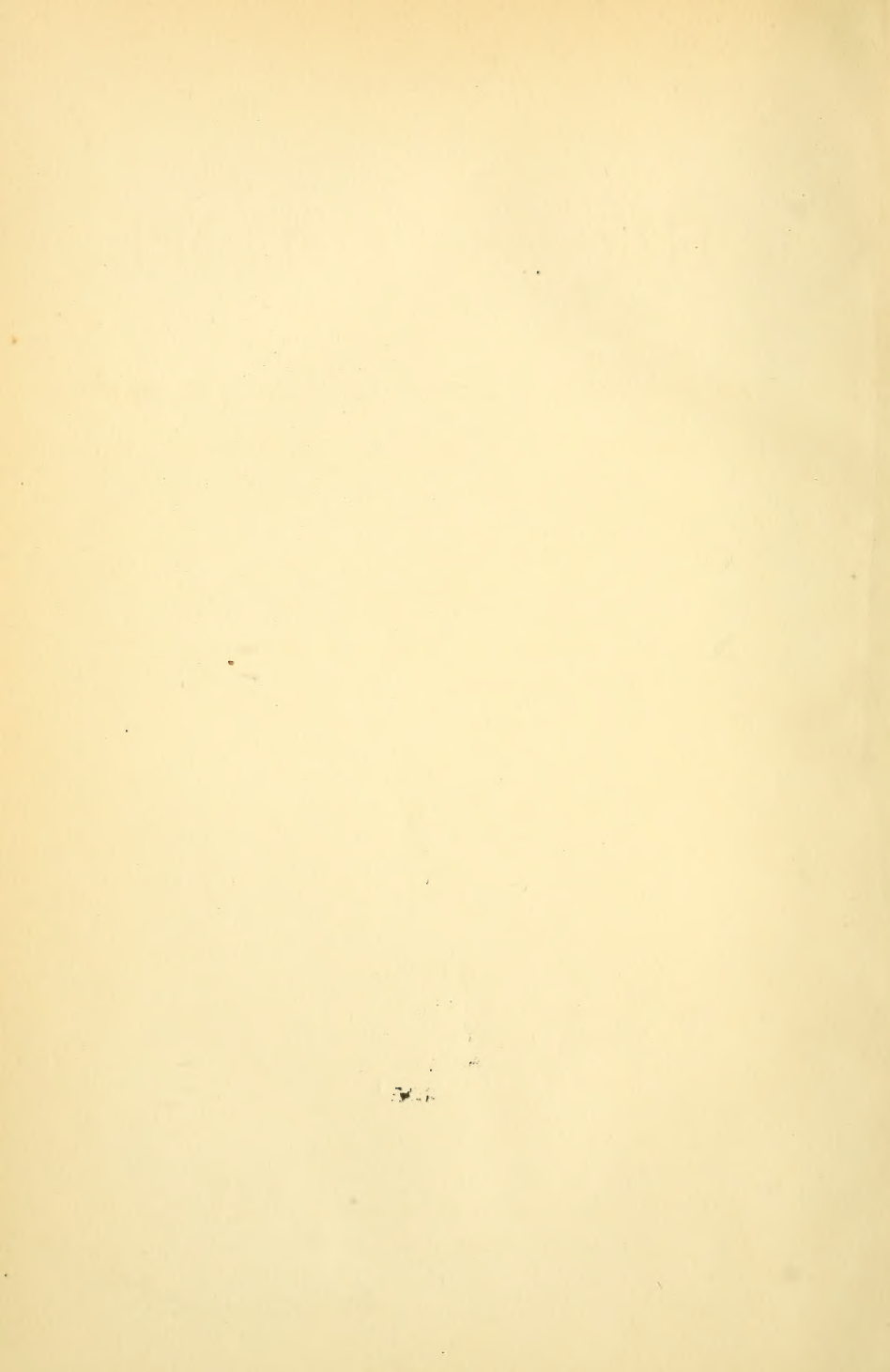
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THE MICROSCOPE.

AN ILLUSTRATED MONTHLY DESIGNED TO POPU-
LARIZE THE SUBJECT OF MICROSCOPY.

Edited by
CHAS. W. SMILEY, A. M.

VOL. IV, NEW SERIES. (Nos. 37-48.)

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THE MICROSCOPE.

JANUARY, 1896.

NUMBER 37.

NEW SERIES.

Objects Seen Under the Microscope.

BY CHRYSANTHEMUM.

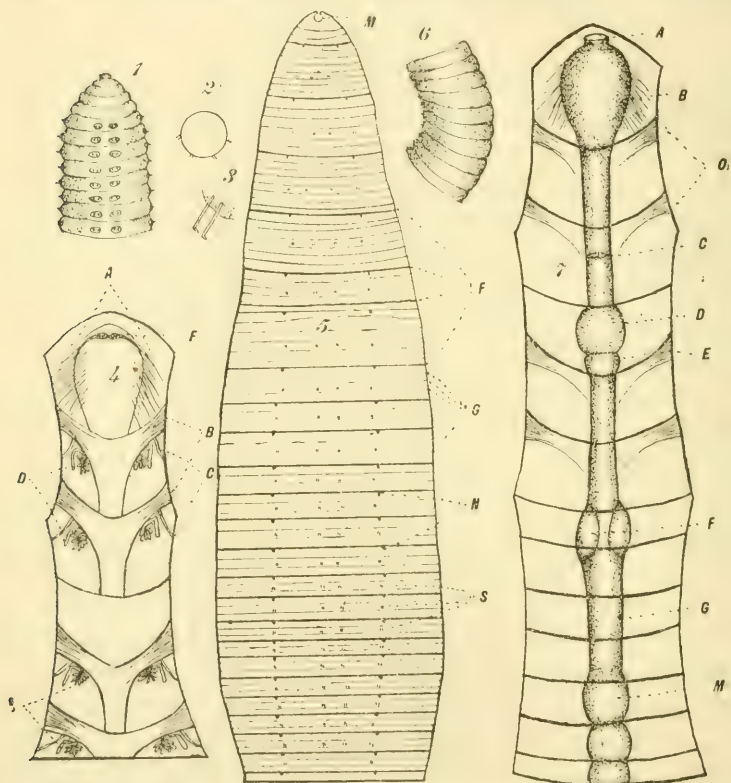
XXX.—THE EARTH-WORM.

Notice an earth-worm in the garden, how it winds rapidly along the ground, then thrusts its head into the soft earth and disappears. Examine it more closely and you perceive no feet, wings, fins, or limbs of any kind, only a long cylinder of soft flesh divided into numerous successive rings, and tapering at each extremity. Even the nose which penetrates the soil is not hard or bony but composed of the same soft kind of flesh.

Place the worm in a deep cell and put it under a low power of the microscope. The segments will be seen more distinctly and as it moves, on either side of its body, little spines may be seen advancing or receding from each segment. Also notice when the body is curved (figure 6) that the segments are larger at one side than at the other and that the spines are quite prominent at the smallest side. By careful focusing it may be seen that these spines are used in much the same way as the oars of a boat. This movement is better seen in one of the little worms found on decaying leaves in an aquarium, for here the body is so transparent that the action of the setæ is very plainly seen.

With a little chloroform kill one of the earth-worms and with a pair of sharp scissors cut out a small piece, say two or three segments, from a comparatively transparent part, wash it carefully, then press it between two slides and examine. You will probably see several

groups of hooked bristles resembling figure 3; these are the little points that projected from the sides of the body and are arranged so that the hooks point backwards thus keeping the animal from slipping. In the common earth-worm of our gardens these bristles or setæ are arranged with four groups to a segment and two bristles



in each group. There are two ventral groups and one on either side of the body (figure 1). Sometimes there are nine groups of setae and there may be several bristles in each group. Sometimes they extend over the dorsal as well as the ventral side of the body. Sometimes they are arranged in regular rows as in figure 5, or they may

alternate and sometimes they are regular in the anterior part and alternate in the posterior but the ventral line usually remains the same throughout the body.

In figure 5, the worm is represented as having been cut down the back and laid open. The heavy lines (f) represent the divisions between the segments, while g represents the smaller divisions of these segments. Notice how many more small divisions there are in the first twenty segments from the head. This is the part which contains the vital organs and below these there are usually two lines of division only. This figure also shows the position of the setæ (figure 5, s) and of the nephridia or breathing pores (figure 5, n).

Now take the first five or six segments, soak in a little liquid potassæ, wash and press between two slides. One will probably be able to see the pharynx (figure 7, b) but certainly the strong muscles which move the head (figure 4, a). Take another head, cut it down the back and lay it open on the slide, then press. The septa or large muscles which move the body (figure 4, b) may be seen and sometimes the smaller ones (figure 4, e); but in nearly all specimens whether open or not little red conically shaped projections may be seen. These are the nephridia (figure 4, d). There are usually two of these in each segment and they are connected with a bunch of tubules (figure 4, e). The worm has a gland which answers the purpose of a heart and has a nervous system; figure 4 f shows the position of the cerebral ganglion, the principal gland of this system.

The digestive apparatus is divided into pharynx, œsophagus, gizzard and intestine. The food is taken into the mouth, thence it goes into the pharynx (figure 7, b), from there through the œsophagus (figure 7, c), and a portion of the intestine into the two-lobed gizzard (figure 7, d and e). From the gizzard the food passes through

the intestinal glands (figure 7, f) and thence through the single intestine to the sacculated intestine (figure 7, m). Some species of worms have three gizzards and the number and arrangement of the sacs vary in the different species.

Although so seemingly insignificant, the worm is of benefit to man, for by its industry it keeps the ground mellow and leveled and prepares the dead grass and leaves for absorption by the soil. Worms vary greatly in size, some being microscopic while in Ceylon there is one which measures from 20 to 40 feet. They are found not only in the earth but in both salt and fresh water.

On a New Form of Mechanical Stage.

By ARTHUR M. EDWARDS, M. D.,

NEWARK, N. J.

I wish to describe as well as I can without figures, a new form of mechanical stage which I have had put on my microscope. For it is a microscope without a mechanical stage itself, made with a fixed stage, a common kind of microscope. But I know that the new mechanical stage I am about to describe can be put on an expensive stand with advantage. It can be moved in any way that is desired and can be removed from the microscope stage and quickly replaced. It can be moved up and down by means of an extremely fine screw placed on either side. In this way it becomes a tilting stage also, making it useful when magnifying stereoscopically with even a one fifth objective. Besides these advantages it is cheap. I think it can be made by oneself—at least the one that I have was home made and I do not claim any superior mechanical skill.

A fixed stage three inches long by two inches broad with spring clip is used for holding it. This is of course

the ordinary fixed stage of a microscope. On this is placed the mechanical stage I am about to describe.

A slip of thick sheet brass, about one thirty-second of an inch thick is taken. It is six inches long and three inches wide. It is also provided with spring clips to hold the object on. It is bent at the two ends so as to make a double stage like a v at each end, leaving about a half an inch between the upper and the lower portions. On each v-piece two cuts are made so that on each side a portion is left which is bent up so as to make a spring to bear the stage downwards. Acting against the two pieces are two fine screws fixed in the bent v-shaped part. These screws have large heads to use with the fingers, first the right and then the left. Of course there is a hole about a half of an inch in the centre of the mechanical stage to view the object with and opposite the hole in the centre of the fixed stage-proper.

Now when in use it is placed on the fixed stage. When the object on a slide is placed on it under the spring clips, it can be moved about up or down, transversely and from right to left. It can likewise be moved the same way as the objective by the screws and the springs acting against them. It can be entirely removed and the fixed stage used alone. It can also have index marked on it and the fixed stage marked with fiftieths of an inch up and down and transversely so that the object can be indexed. In fact I think it is simple and cheap and also effective. I wish it could be tried.

Eggs of Bot Fly.—The eggs of the bot fly (*Gasterophilus equi*) mounted attached to the hair make very pretty transparent or preferably opaque objects. They may be found in abundance on farms where horses are raised, especially on horses that have long run in the fields. The eggs are deposited on the hairs generally of the forelegs and mane, whence they are taken into the mouth and swallowed. The larvæ are hatched in the stomach.

On Identifying Minerals.

By MELVILLE ATWOOD,

SAN FRANCISCO, CAL.

[Report of a paper read before the San Francisco Microscopical Society.]

The minerals which have been generally adopted as representing the degree of hardness in minerals were suggested and introduced by Mohs, and are as follows : Tale 1, rode salt 2, calc-spar 3, fluor-spar 4, apatite or wolf-ram 5, feld-spar 6, quartz 7, topaz 8, sapphire 9, diamond 10.

Many years ago the speaker had found considerable difficulty in determining, with any degree of accuracy, the hardness of minerals, the scale of hardness then in use, and probably still at many colleges, being a small box containing samples of the different minerals and a penknife. The knife was seldom hard enough to scratch wolfram representing 5 in the scale. To the prospector or miner it is of the greatest importance to be able by some simple means to determine the degree of hardness. Many fragments of corundum and quartz have been sent long distances to have them determined, the sender thinking them diamonds.

It had been found, after many trials, that the easiest mode of determining hardness was to have the minerals representing the various degrees mounted something like a writing diamond. For this purpose break the corundum, topaz, etc., into small fragments, and after selecting those with fine, sharp points, proceed to mount them in the following manner : Take a small rubber-tipped pencil and extract the rubber from it. Then with a spirit lamp melt some lapidary's cement into the vacant space ; with a small pair of plyers take the fragments of minerals, heat one end, and insert it into the cement. While the cement is warm, by wetting your finger, you can mold it into any shape you please ; and when cold, it will harden and answer just as well as if set in metal, with the advan-

tage that you can renew it at any time in a few moments.

In the examination of rocks the specimen selected should have a good, fresh surface of fracture, of a size about 3 by 5 inches, and $1\frac{1}{2}$ inches thick. With a trimming hammer prepare the narrow face or edge, so that by rubbing it on emery blocks you can get an even surface or polish on it. Then heat the specimen so you can hardly handle it. When in that condition rub Canada balsam on half of the polished surface. When cold it will harden so that you can handle it without injury. By this method the different constituents of the rock are much better seen, and the inspection of the outer surface, viewed as an opaque object with a common magnifier, say of three diameters, set in a spectacle frame, gives all the information ordinarily required by the mining engineer. The even surface not covered by the balsam can then have the hardness of the different crystallized minerals to be seen on it easily determined, and also treated with acids, applying the same with a pointed glass rod dipped in the acid. The action, if any, can be seen, and also the smallest scratch, when testing for hardness, will be made visible.

The use of the lenses mounted in a spectacle frame is recommended to the miner or geologist in the field, as it is scarcely possible to examine the streaks of minerals when they occur in very minute crystals and keep the lens in focus when holding it in one hand and working for the scale of hardness with the other.

There was shown under the microscope a small fragment of what is called "carbonate," or diamond carbon. Bahia, Brazil, produced at one time large quantities of the carbonate. Its hardness is identical with the white diamond, and in structure it is porous, so much so that it resemble pumice stone. This fragment was taken from the Yellow Jacket diamond drill, at Virginia City, Nev. The drill penetrated the rock below the gold and silver

ores of the Comstock lode at a depth of over 3,000 feet, when they met with hot water.

Should the minerals forming the rock be too small to be seen with the common lens, a microscopic section will have to be cut. The process is a simple one, but requires patient and skillful treatment to produce a section thin enough for a full view of its structure. Mr. Atwood had two sections thus prepared from the hanging wall of the Keyston mine, Amador county, at the thousand-foot level, one to show color and texture, the other to be examined by polarized light.

The Microscope as a Detective.—The other day there was a great robbery in South Africa of gold coins from a mail-cart. They had been consigned in wooden cases. The thieves took the gold out and filled the cases with sand. The police have been unable to discover where this exchange was made. Why not employ the microscope? Some years ago Ehrenberg, that old prince of microscopists, was employed by the Prussian Government to investigate a case of smuggling. A cask had been opened, valuables extracted, and the case repacked and shipped onward to its destination. The only clue to the criminals was that the unpacking must have been done at some of the custom houses through which the goods passed.

To all appearance the microscope had a hopeless task. But not so. Ehrenberg took some of the sand that had been used in the repacking, placed it under his microscope, looked through his magic tube, and behold! there on the stand lay a peculiar specimen of foraminifera. That animal was found at only one place in the world, and told just where the crime had been committed. Possibly an examination of the sand found in the South African cases, seeing they had travelled a great distance, might by chance reveal the particular point in the route where the theft took place, and thus lead the police to the trail of the robbers.—*Science Siftings*.

THE MICROSCOPE.

New Series, 1893.

For Naturalists, Physicians, and Druggists, and Designed to Popularize Microscopy.

Published monthly. Price \$1.00 per annum. Subscriptions should end with the year. The old series, consisting of 12 volumes (1881-1892), ended with December, 1892. Sets of the old series cannot be furnished. All correspondence, exchanges, and books for notice should be addressed to the Microscopical Publishing Co., Washington, D. C., U. S. A.

CHARLES W. SMILEY, A. M., EDITOR.

EDITORIAL.

Romance.—On the first of January, 1896, the magazine "Romance," which has heretofore been devoted to fiction entirely, underwent a complete change and was issued as a five-cent magazine, filled with illustrations of a popular kind. The magazine will be a considerable novelty; the idea being to emphasize the illustrated side of it rather than the text. There will be 48 pages containing not less than 60 illustrations, printed from the best of plates on the best of paper. There will be pictures of noted painters, of people of the day, of literary individuals at home. Scientific matters will be treated of, and amateur photography will be given a generous space.

The Tolles Microscopic Objective.—Ephraim Cutter, M. D., LL. D., of New York, assisted by Charles X. Dalton, of Boston, exhibited the famous Tolles one-seventy-fifth microscopic objective to the members of the regular monthly meeting of the New England Association of Opticians at Young's Hotel last month. The exhibition was very interesting.

An experiment was performed by drawing a small drop of blood from Dr. Harriman, and allowing the spectators to see it. The meeting was presided over by President Charles A. French. The committee having charge of the exhibition consisted of Edwin P. Wells, chairman; Leslie Millar and W. H. Doleman.

Dr. Cutter said that Mr. Tolles was three years constructing the lens for Dr. Harriman, who paid \$400 for it. After he had solved the problem on which he was working, Dr. Harriman sold the objective to Dr. Cutter. Mr. Dalton who assisted Dr. Cutter, was Mr. Tolles' partner and succeeded to the business after Mr. Tolles' death.

At the business meeting of the association, George H. Lloyd resigned the office of treasurer, as he expects to go South for the winter, and A. H. Martin, of Boston, was chosen to succeed him. J. E. Whiting of Andover, Mass., and Frank and Carlos Huckins, of Ashland, N. H., were elected members.

The committee on the Tolles Memorial reported favorable progress, stating that some money had been collected. It was announced that Dr. Williams, of Boston, would speak at the next meeting of the association. Dr. Cutter offered to give in Boston a public exhibition of views taken with his objective, the proceeds to be devoted to the Tolles Memorial Fund.

The treasurer of the Tolles Monument Fund reports that he has received \$100 up to Dec. 1.

A. J. Landry	.	.	.	.	.	\$1.00
W. R. Donovan	.	.	.	.	.	2.00
E. M. Parks	.	.	.	.	.	2.00
Charles A. French	.	.	.	.	.	5.00
Dr. George B. Harriman	.	.	.	.	.	10.00
W. G. Corthell	.	.	.	.	.	1.00
F. H. Blackington	.	.	.	.	.	2.00
John W. Sanborn	.	.	.	.	.	10.00
A. G. Barber	.	.	.	.	.	5.00
Geo. H. Lloyd	.	.	.	.	.	10.00
E. G. Worthley	.	.	.	.	.	1.00
R. H. Wigler.	.	.	.	.	.	1.00

B. V. Howe, Treasurer.

Staining Milk Vessels of Plants.—Chimani (Archiv Pharm.) finds a combination of alkanin and acetic acid very serviceable for differentiating the sieve-tubes and tannin sheaths. He extracts extract of alkanet with ether, dispels the ether, treats the residue with 45-per cent glacial acetic acid, and lastly, slightly concentrates the resulting acetic acid alkanin solution by evaporation on the water-bath. This stain acts both on dry and fresh plant parts.

QUESTIONS ANSWERED.

NOTE.—*Dr. S. G. Shanks, of Albany, N. Y., kindly consents to receive all sorts of questions relating to microscopy, whether asked by professionals or amateurs. Persons of all grades of experience, from the beginner upward, are welcome to the benefits of this department. The questions are numbered for future reference.*

232 *Outside of Carpenter's work, which author has the most explicit directions for staining and mounting sections?*—D. E. L.

Clark's Practical Methods in Microscopy gives detailed directions for staining and mounting sections. Cole's Methods of Microscopical Research, last (1895) edition, is a very practical work. Gage's book does not give directions for staining sections.

233 *I have a Zeiss Binocular Eyepiece. It was damaged in transit and was repaired by B. & L. The left eyepiece does not show the object distinctly, and shows also two margins close together of every object. Is this a necessary result of the double prism, or can it be corrected?*—D. A. N.

There are two prisms in the *axial tube* beneath the axial eyepiece, which should be very nearly in contact (within 1-2500 inch). This less than optical contact causes part of the cone of rays to go to the left. If there is any great separation of the prisms some of the rays will be reflected from the inner "surface" of the lower prism and some rays will be reflected from first the surface of the upper prism and these two images will not coincide in the left eyepiece. The image in the left or lateral eyepiece should be distinct, but not quite as bright as in the axial or direct eyepiece.

PRACTICAL SUGGESTIONS.

By L. A. WILLSON,
CLEVELAND, OHIO.

Mushroom Spores.—The agariani or gill bearing fungi are classified according to the color of their spores. To obtain the spores, separate the stem from the pileus or cap, and invert the latter with the gills downward, upon a piece of glass or white writing paper. In the course of an hour or two the spores will be found on the glass or paper. Place a few in a

drop of water on a slide cover and examine with a quarter objective. It has been said of these spores, "they are infinite"—for in a single mushroom 10,000,000 have been visible.

Revolving the Turn Table.—When preparing several slides it is often desirable to cause the turn table to revolve rapidly and to do so without the constant use of the finger.

One way is to wind a string around the shaft and quickly jerk it off as a top is spun.

Where a large number of slides are to be prepared the table may be made to revolve with a toy steam engine or electric motor.

How to Obtain Objects at Home in Winter.—A microscopist, unable on account of winter, to scour the fields and woods in search of objects can obtain an endless supply of amusement and instruction by examining the water supply. Nearly every month will display a new flora and fauna that will furnish ample problems for solution. The examination of textile fabrics and of different kind of hair will cause many an hour to pass pleasantly away. Then in winter the making of slides of crystals and crystalizations for the polariscope will be time well spent.

SCIENCE-GOSSIP.

Examination of Spots on Clothing for Spermatozoids.—Those who have had to conduct such examinations know how difficult the investigation becomes when the material is very porous, and will welcome the following suggestions of De Nobele: Cut the material into two little scraps, and place the latter, with the stained surface downward, into a 1 per cent. solution of sodium chloride, or in distilled water carrying one-half of one per cent (1 : 200) of alcohol. Let it remain for several hours, or say over night, and then remove each scrap separately and press between a slip and cover-glass. Dry slips and covers, and after drying plunge for a moment into a 1 per cent solution of fuchin. If spermatozoids are present they can be found with great readiness in this way.—*Nat. Druggist*.

The Examination of Pepper.—W. Busse, in *Mittheilungen der Gesundheitsamt*, states that most of the analytical methods for the valuation of pepper, such as the determination of the moisture, ethereal oil, mineral matter, alkalies, and phosphoric acid, are inconclusive, since these constituents are common to the seed and the husk. The value of the cellulose and dextrose estimations must also be called in question. On the other hand, the brown coloring substances are only found in the husk, and their quantitative estimation will show the value of the pepper. To isolate them the following method is proposed: Five grams of the sifted and dried pepper are treated with boiling absolute alcohol. The residue, after being freed from alcohol in the drying oven, is ground up with a little water in a basin, and then washed into a flask with 50 to 60 c.c. of boiling water. Twenty-five c.c. of a 10 per cent solution of soda are added, and the flask is warmed on the water-bath for five hours with constant shaking. Concentrated acetic acid is next added until the liquid is only feebly alkaline, then 250 c.c. of water, and the flask is well shaken. After twelve hours the liquor is filtered with the aid of a suction-pump. To 50 c.c. of the filtrate concentrated acetic acid is added to acid reaction, followed by 20 c.c. of a ten per cent solution of lead acetate in dilute acetic acid. After mixing, the liquid is diluted to a 100 c.c. with water, well shaken and filtered. Ten c.c. of the filtrate are decomposed with 5 c.c. of H_2SO_4 (1:3) and 30 c.c. of alcohol, the precipitate filtered after some time, washed with alcohol, and the lead sulphate ignited and weighed in the usual manner, and the amount of lead calculated. The amount of lead (in grams) which has been obtained by the process from 1 gram of dried pepper, may be described as the "lead number." The figures given by the different kinds of pepper are:

	Lead Number.
White pepper.....	0.006 to 0.027
Black pepper.....	0.054 " 0.075
Husks.....	0.129 " 0.157
Pepper dust.....	0.109 " 0.122

The author concludes that this method, taken in conjunction with the determination of the ash and sand and the microscopical examination, should be of great assistance in estimating the value of pepper.—Analyst.

Why Should the Pharmacist Know How to Use the Microscope.—Not to examine the menagerie of a drop of water or the “dust” from a butterfly’s wing. Not for play or display. But for serious, matter-of-fact, practical every-day work. He needs it for microscopical examinations of drugs, powders, crystals, urinary sediments; for the detection of impurities; for the identification of bacteria; and for other purposes connected with the duties of the educated pharmacist of the immediate future.

But the uneducated druggist does not need a microscope, for he cannot use it. To learn how to use it intelligently and safely, demands considerable knowledge and practice under such training as is possible only with experienced teachers who have proper laboratory facilities at their disposal.

Even the well trained pharmaceutical chemist could not do such microscopical work as we have referred to, without facilities such as cannot be found in one retail drug store out of a hundred. On the other hand, if he have the requisite training and the necessary facilities he will find an abundance of work to be done.—*Bulletin of Pharmacy*.

Permanent Mounts for Saccharomyces.—A correspondent writes to know if there is a method of making permanent mounts of yeast and similar ferments. The following is a process that we have employed for several years with excellent results, but we do not remember to whom we are indebted for it. Place the ferment on the cover-glass, and carry through a flame exactly as in preparing bacillus tuberculosis, etc., or if you have plenty of time you may let it dry spontaneously. The stain is an alcoholic solution of hæmatoxylin prepared as follows: Dissolve 4½ grains of hæmatoxylyn in 2 drams of absolute alcohol, and add 10 drops of a 3 per cent aqueous solution of alum. Shake well and put in a light, warm place, and leave for three or four days. Filter and preserve in a glass stoppered vial. In this fluid float the cover glass, prepared side downward, for fifteen minutes. Wash, dry carefully, and mount in xylol balsam or dammar. Such mounts keep indefinitely. We have some several years old that are as good as when fresh.—*Nat. Druggist*.

Staining Fresh Tubercular Sputum.—According to Kantback and Drystale, says the *Pharmaceutical Journal*, a thin layer

of the sputum should be poured into a glass dish placed on a dark background, and one of the characteristic yellowish particles picked out with a pair of fine-pointed forceps. This should then be squeezed between two clear cover-glasses, the films are allowed to dry in the air, and then passed three times through the flame of a spirit-lamp or Bunsen burner. The glasses may then be floated on a warm carbol-fuchsin solution for two to five minutes, washed rapidly in water to remove excess of fuchsin, decolorized in 25 per cent hydrochloric acid, washed in 60 to 70 per cent spirit till no more red comes off, washed in water to remove spirit, dried between filter paper, and again pass through the flame three times. Next stain in Löffler's methylene blue for ten to twenty seconds, wash once more in water, dry between filter paper, and again pass through the flame. Finally, mount in xylol balsam, and on examination the bacilli will be seen to be stained red on a blue ground. It is suggested that the water, acid, spirit and methylene blue should be kept in wide-necked, glass-stoppered pots. The cover-glass is held in a pair of forceps, and passed successively from one pot to another, thus effecting economy both of time and material.

Best Possible Illumination of the Microscopical Field.

—The following plan, says the editor of the *National Druggist*, is not generally known, but in his experience it yields the best possible illumination when using a condenser and when working with high-power objectives: After the object has been placed on the stage and the instrument is in the desired position, remove the ocular from the tube and look down the latter with the naked eye. Whether you are using the mirror alone, or the condenser, or whether you are working with natural or artificial light, you will see a reversed image of the source of illumination. Now, with the ocular still removed, arrange your mirror or your condenser, or both, so that you get the best possible light, and that the illumination thus obtained shall be as bright as possible over the entire field of vision. When operating with natural light you will soon be able to throw upon the object the spot of sky from which the light comes, and avoid the mullions of the sash or castings of the windows through which the light enters the room. If a lamp is used it will be but little trouble to bring the image of the flame directly into the center of the field of vision.

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THE MICROSCOPE.

FEBRUARY, 1896.

NUMBER 38.

NEW SERIES.

The Spoiling of Fermented Drinks.

BY A. DEROS.

Translated from *Le Micrographe Préparateur*.

THE BLUE INFECTION.—This alteration, although very rare in red wines, is quite common in the white wines, since the grape vines have become infested with many different species of mushrooms. The flat wines, containing little acid or alcohol, are most susceptible to this change, especially if they are rich in nitrogenous substances. Wines which should be clear when drawn, then become muddy and of a bluish color when looked through. M. Robinet attributes this change to the presence of mycodermes having a strong resemblance to mycoderma aceti. With a high power of magnification the presence of grayish mycodermes, which multiply by budding, can be distinguished in these blue wines.

To counteract this blueness, add to the wine a quantity of alcohol sufficient to bring it up to 12 degrees; the acidity can also be brought back to five grammes by the addition of citric acid. If the disease resists this, it will be necessary to add six or eight grammes of tannin to the hectolitre and afterwards make a strong *collage*.

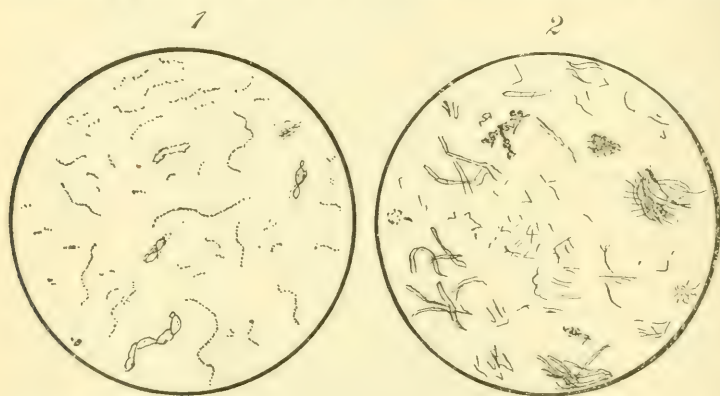
THE GREASY INFECTION.—White wines, champagne in particular, sometimes become sticky, slimy, stringy, and quite unfit to drink. This change takes place not only in wines in casks but also in bottled wines which are properly corked and cared for. It is the grease.

There is produced in the wine a particularly sticky substance, which has been called gluten, gliadin, *glaita-*

dine and finally *viscose*. Where does the substance come from? Did it pre-exist in the wine in some soluble form, and was it brought forth to be precipitated in this sticky appearance by which we know it? This opinion, held by some scientists, seems now to have been abandoned.

It is admitted that the *viscose* is the product of the evolution of a special ferment in the same way as alcohol and carbonic acid are products of *Saccharomyces*; but there is a difference in opinion upon the nature of the ferment which produces the *viscose*.

M. Krammer (*Annales agronomiques*, 1890) has cultivated in sterilized wine a ferment formed of very fine



elongated sticks. This ferment planted in the sterilized wines renders them viscid at the end of one or two months.

Pasteur has found in all the wines affected as are these which we are studying, a ferment formed of round globules which are not more than one micron in diameter, very rarely isolated and more often united in long flexible chains (fig. 1). It is to this ferment that nearly all connoisseurs attribute the formation of *viscose*.

When it is developed in wine in the casks, a fraction of it forms a scum on the surface, while the remainder is deposited at the bottom. When found in wine in bottles

it does not form a scum but the greater part is deposited, while the rest is mixed with the liquid.

The best remedy for this grease is to add to each hectolitre of the wine, from five to ten grammes of tannin dissolved in alcohol, and after mixing thoroughly let it settle for some time to form a good *collage*.

THE BITTER INFECTION.—This disease, which attacks by preference the fine wines of Burgundy, shows itself only when the wine is old. The wine at first loses its flavor, then becomes bitter, and throws off a peculiar odor, the coloring matter is altered and forms a deposit. At this time the wine becomes undrinkable, but as this change is only produced slowly, if it can be arrested when the bitterness commences to manifest itself, the wine may still be excellent. (Pasteur.)

At the same time a bitter substance, which Maumené thought to be aldehyde of ammonia, and which other chemists believed to be citric ether, is formed in quite large quantities from the carbonic acid. The acidity of the wine increases, at least that part furnished by the volatile acids, and in particular by the *etique* acid and the *butyrate*.

The alteration is chiefly in the coloring matter and in the tannin, and it also appears in the glycerine.

The bitterness is due to a ferment discovered by Pasteur. In the deposit which forms in the diseased wine numerous long and very slender sticks are found. These sticks form articulated filaments; the articulations are rigid and the branches irregular. The ferment is often associated with crystals or with little mammillated masses. It is generally impregnated with coloring matter (fig. 2). One can, by treatment with alcohol or acidulated water, carry off with the ferment the foreign matters which soil it. It then takes its original appearance.

When the bitterness first appears in a wine it can be

saved by making it into brandy. Some authors recommend putting alcohol in the wine and the addition of tannin, but making it into brandy is especially recommended.

We will now review the impairments of wine which have been most thoroughly studied. Many of these have been confounded and taken the one for the other. It will be understood besides that the definite products of the evolution of the microbes which occasion them can vary with the nature of the unfermented wine, the temperature, &c. In certain cases, several of these minute organisms may develop at the same time, and give us as final results products much more complex than when they are isolated.

Also some changes in the wines may come from diseases in the grapes from which they were made, for example, the musty taste of wine, made of grapes attacked with mildew.

The diseases of wine, whether studied or not, come from the presence of micro-organisms, and the conclusion to be drawn is that great watchfulness is necessary, that the most scrupulous cleanliness ought to be maintained in the casks and in the cellars and also in the materials used. Finally when in spite of all these precautions a change manifests itself, it is not necessary to hesitate to act, the procedure the most sure to cut short the ravages which threaten, is without doubt, making it into brandy by Pasteurization.

Correction.—In my paper on a new form of mechanical stage in the January number, I speak of “a double stage like a V at each end.” It should read, “like a U at each end.”—
ARTHUR M. EDWARDS, M. D.

Fermentation of Bread.

K. E. GOLDEN.

LAFAYETTE, IND.

The production of bread is of vital importance to a people, as it furnishes so large a part of their diet, this being specially true of fermented bread. While the baking powder companies have advertised so extensively and gotten cooking school teachers to advocate their wares so persistently, the majority of the people still insist on preferring the fermented bread. Yet, compared with other articles of diet, it has received very little attention from the scientific point of view. People are content to take what they can get from the bakers, or else to cling to the old methods of making it at home. Scientists abroad have studied the fermentation of bread to determine what caused it, this being specially true of the leavened breads. But little attention has been given to the subject from the point of view of making better bread, and of controlling the fermentation by determining what organisms caused it, then using only those organisms from which most desirable results could be obtained.

Work of this nature has been taken up by investigators on beer, and now brewing is reduced to a science. The work in this direction is of comparatively recent date, but a great deal has been done, as was to be expected from such men as Pasteur and Reess, and at the present time, Hansen. At first thought there does not seem to be much connection between the art of bread-making and that of brewing, but that there is a very close one, has been amply demonstrated.

Bread-making is of very ancient origin; our prehistoric ancestors knew the art as early as the Stone Period, as excavations made on the site of the lake dwellings in Switzerland have given proof, and witness also its frequent mention in the Bible. The Egyptians were well

up in the art; they baked cakes and loaves of various shapes and varieties, using several kinds of flour, which they flavored with aromatic ingredients. From these the art spread over Europe, the people of the several countries taking to it eagerly, except those in the extreme north, and even to this day it is carried on sparingly there.

Many changes have come in the manipulation, and attempts have been made to use other methods for lightening the bread. Where chemicals have been introduced into the dough to generate the gas in it, the bread must be eaten while fresh to be palatable; and aeration gives a tasteless bread. But taken all in all, we are not so far ahead of the ancients in the matter of fermenting the dough. In the matter of preparing the flour great progress has been made.

Fermentation consists, essentially, in the breaking up of chemical compounds, the molecules being separated and recombined into more stable compounds. The fermentation is always accompanied by a rise in the temperature; this can be noted easily by plunging a thermometer into rising dough, or a fermenting liquid. The fermentation in bread is the same as that in beer and other fermented beverages—an alcoholic one. It consists in the breaking up of the molecules of sugar into CO_2 , alcohol, succinic acid, glycerine, and a number of bye products, which vary in quantity and nature with the kind of yeast used, and the conditions under which growth has taken place.

There are other ways of fermenting bread than by means of yeast. The old method being to mix together flour, water or milk, and mashed potatoes, the potatoes being a good food for micro-organisms, the dough being then allowed to stand until a spontaneous fermentation had taken place. This method is still practised in country places where yeast is difficult to obtain, and is the same process as the leavening of the ancients. A quantity of

the leavened dough is saved usually for the next baking to facilitate the action.

Another form of this spontaneous fermentation is carried on in what is known as a salt-rising bread. In this the fermentation is brought about by micro-organisms, it not being known which one or ones produce the alcoholic fermentation. In some experiments which I made on salt-rising bread, in no case was yeast or any of the budding fungi found, but in every case large numbers of bacteria, four different kinds being constant. That is, in plate cultures made from rising dough, there were four forms that differed from one another in various respects that were always found. Other forms beside these were found sometimes, but were not constant.

In the manufacture of bread as ordinarily carried on some form of "pressed yeast" is used, either the moist or the dry. The dry cakes usually have a small amount of yeast and a large amount of corn meal or some flour. The moist has a large amount of yeast, and a small amount of starch, usually that of the potato. The yeast is *S. cerevisiæ*, or brewers' yeast.

Yeast is a unicellular plant, without chlorophyll, thus belonging to the fungi. The cells are round, oval, or in some species very much elongated. The cells consist of a definite cell-wall, which encloses a mass of granular protoplasm. The wall consists of cellulose, which is somewhat delicate in young growing cells, but much thicker in old or resting cells. In the protoplasm are a number of vacuoles, a nucleus is present, but is difficult to see, so that special treatment has to be given for its demonstration. Yeast reproduces ordinarily by budding.

When the yeast is placed under favorable conditions for growth, the wall of the cell, usually near one the poles, bulges out; into this, protoplasm presses. The cell now consists of two unequal parts, the smaller one,

the daughter-cell, eventually separating from the larger one, the mother cell. This separation may not occur until after the daughter-cell or "bud" has begun to produce daughter-cells itself. The connection between the mother and daughter cells may persist for several generations if the yeast be growing actively. Size? *S. cervisiae* 6-8 microns in diameter, 5-11 long. *S. pastorianus* 7-8 microns in diameter.

Another method of reproduction is possessed by yeast: that of endogenous division or formation of ascospores. Under certain conditions the protoplasm within the cells divides into two, three, or four rounded bodies, that become surrounded by a cell-wall, thus giving rise to a number of cells within the original cell; this latter is called an ascus, the contained cells, ascospores.

In brewing there are two varieties of yeast employed which produce characteristically different fermentations, and are known as top and bottom yeasts. The top yeast works at a comparatively high temperature; the action is rapid, and the yeast is at the surface of the liquid. This top yeast is used in the brewing of ale and porter. The bottom yeast works at low temperature, the action is slow, and the yeast is at the bottom of the liquid. The bottom yeast is used in the brewing of lager beer.

There are also what are known as "wild" yeasts in distinction from those that are cultivated. To the wild yeasts are due the fermenting of fruit juices; as, grape and apple. Sweet cider will always show, under the microscope, one of these characteristic forms. The yeast is found on the skin of various fruits, and on the ground under the trees; from here it can be carried as a fine dust by the wind. It is supposed that the cultivated varieties of yeasts originated from these wild forms, though notwithstanding their frequency, I have never been able to get one from flour, but have gotten the hay bacillus, *B. subtilis*, in large quantities.

There are three periods in the study of fermentation. The first was based upon the question as to the coming into existence of micro-organisms by spontaneous generation. From this followed the method of sterilization. The next was the Pasteur period, in which Pasteur proved that bacteria exert a great influence in fermentation, usually a bad one. The third period may be called the Hansen period, which is certainly as epoch-making as that of Pasteur, for Hansen has proved that the diseases of beer are caused mainly, not by bacteria, but by yeast itself. He it was who devised a method for cultivating pure yeast, obtaining his cultures from a single cell. This makes it possible to separate from one another the different species of yeast. This has been of immense value in the brewing industries, for varieties have been studied, and those possessing certain desirable properties selected for use; besides, a brewing started, absolute certainty could be felt as to the result, and that result duplicated at any time. Yet, in bread-making, similar problems present themselves to those of brewing:—To determine which form of yeast will give desirable results as regards taste, lightness, duration of fermentation, and keeping properties. At the present time, one gets yeasts in the market under various names, without knowing just exactly what properties will be given by the yeast selected, and whether the results can be duplicated. Then one gets sour bread occasionally without any apparent reason following from the making.

Of course, the souring is due to the fact that the yeast was not pure, it containing in many cases different kinds of yeast as well as moulds and bacteria. The form most probably causing the souring is *B. aceti*, a bacterium that attacks acid solutions, containing a small amount of alcohol. The dough furnishes a good nidus for its growth after the alcoholic fermentation has taken place. There

are various other products formed by the bacteria and moulds that are present.

I have been making some experiments on bread, using pure cultures of yeast. Three different yeasts were used ; one separated from a compressed cake, another from a dry cake, while the third was obtained from what is known as potato yeast, i. e., a culture of brewers' yeast in an impure condition in potato solution. The form occurring in greatest abundance in the cakes and solution respectively being the ones used.

Control experiments were carried on at the same time, using ordinary compressed yeast. Best results were obtained from the pure yeast gotten from the compressed cake. The time and extent of fermentation were about the same as that obtained in the control, but the somewhat sour odor one gets in ordinary dough was lacking, and the bread was sweet to the taste.

Some of the dough was kept, that of the control souring the second day, whereas the pure culture gave no indication of souring at the end of two weeks.

The results of the experiments are not so decisive as they are suggestive of the possibilities for pure yeasts in bread-making. A sufficient number of yeasts were not used to determine the qualities which they would give to bread, but sufficient was done to prove that the bread from the pure culture was superior in many respects to that from the impure yeast cake.

In brewing, pure yeasts have been used, and that with the most advantageous results ; to such an extent is this true that Hansen's pure and selected races of yeast are used in breweries in America, Europe, Asia, and Australia. Apparatus has been devised by means of which yeast can be transported to any part of the world in a pure condition, and also apparatus for cultivating large quantities of the yeast for pitching purposes. And, as it has been determined that under brewery conditions, constancy of

characters undergoes but slight changes, why could not the same points be made use of in selecting yeasts for baking purposes?

Besides, looking at it from the point of view of the makers of pressed yeast, a better yield of yeast should result from a careful selection of a cultivated species. Moreover, when people in general understand the action of yeast and fermentation as a whole, better, the prejudices held by some people against yeast will be abolished, and the sensational "scares" that appear occasionally in the newspapers will cease, as will also the pseudo-scientific communications such as those published in the "Century" a year or so ago from a well-known physician connected with the New York Board of Health.

QUESTIONS ANSWERED.

NOTE.—*Dr. S. G. Shanks, of Albany, N. Y., kindly consents to receive all sorts of questions relating to microscopy, whether asked by professionals or amateurs. Persons of all grades of experience, from the beginner upward, are welcome to the benefits of this department. The questions are numbered for future reference.*

234 *How shall I make hay or vegetable infusion, for animalcules, etc?* E. W. P.

Cut some hay or other vegetable matter into small fragments, cover it with tepid water and let it stand in a warm place for two or three days. Water that has contained cut flowers, is teeming with infusoria, especially if at all putrid.

235 *Can you inform me who is the successor of professor H. L. Smith, the Diatomist?* D. A. N.

Dr. D. B. Ward, 27 Garden Street, Poughkeepsie, N. Y. has all the diatom material collected by Prof. H. L. Smith.

236 *Kindly inform me of the most recent work on preparing and mounting, containing specific and detailed methods, general information, etc.—in one volume or single.* C. M. M.

Practical methods in microscopy—by Chas. H. Clark.—Pub. D. C. Heath & Co.

PRACTICAL SUGGESTIONS.

BY L. A. WILLSON,

CLEVELAND, OHIO.

Magnification.—"How much does that instrument magnify?"

Every possessor of a microscope has frequently been obliged to answer this question. In court the same question is generally propounded to the microscopical expert. There is a popular fallacy that the value of a microscope depends on the amount of its magnification. The novice at the microscope is often compelled to gradually recover from this diseased notion. After being entertained by a beautiful microscopical exhibit a neophyte will proceed to a dealer and purchase the best microscope and the highest lenses that money will procure. Those that do so soon consign the instrument to the garret and abandon the pursuit in disgust. We must creep before we can walk. We must begin at the lowest rung of the ladder and ascend. Besides the greater number of the most beautiful and instructive objects are to be seen with objectives no higher than an inch and a quarter inch objective.

Never use a higher power than will clearly show the specimen under examination.

For seeing nine-tenths of the objects for which the microscope is used by an amateur high powers are absolutely useless.

In union there is strength:—Every amateur should if possible find an associate to work with and if possible join a microscopical society. More can be learned in one evening in a society than can be acquired by months of toil. Even two novices by correcting each others errors and by a mutual interchange of ideas can greatly facilitate progress. Working alone is up-hill business and often when passing from seclusion to the open society of the world of microscopists the solitary worker will find that he has entertained many errors which it will require time to eradicate. Of two amateurs, the union of a scientific worker with a non scientific worker of a mechanical turn of mind will generally be found mutually advantageous.

The Microscope in Chemistry.—The value of microchemical analysis, and the simplicity of its processes, commend this department of microscopy to general favor.

A large proportion of the actions and changes produced by reagents may be observed as satisfactorily in drops as in larger quantities.

Great care should be observed when examining chemicals with the microscope. An objective with a gold front will be found servicable.

Some Points on Crystal Slides.—The methods of producing these slides should be varied with the different substances and the different effects desired.

Sulphate of iron dried on a slide will produce arborescent and fern-like crystals but if stirred with a glass rod or needle while evaporating will form separate rhombic prisms.

Pyrogallie acid crystallizes in long needles, but a little dust as a nucleus brings about a change of arrangement resembling the "eye" of a peacock's tail.

A saturated solution dropped into alcohol, if the salt is insoluble in alcohol, will produce instantaneous crystals. Some substances as salicin will produce best results by being fused in a slide over a lamp and spread evenly. This may be done with a hot needle.

SCIENCE-GOSSIP.

The Micro-organism of Measles.—Joseph Czajkowski (Centralbl. für Bakt. und Parasit., 1895, No. 17-18, p. 511) contributes a further addition to our knowledge of the bacillus which he previously described as existing in the blood in measles. The bacilli in the blood vary in length from one-half micromillimeter to the diameter of a red blood-corpuscle, and in cultures grow into long threads. They stain well with all the anilin dyes, and in the longer forms a part of the protoplasm often remains unstained. They lose their stain by Gram's method.

They grow best in bullion or sterile serous fluid from the abdominal cavity, in which a whitish, fairly heavy sediment is formed, which in older cultures becomes yellowish-gray. The cultures have no characteristic odor. Rabbits were always immune to the bacteria. Mice died from septicemia three to four days after inoculation with small quantities of the culture, the bacilli being obtained again in pure cultures from the liver and spleen.

The author believes the bacillus described by him to be the specific cause of the measles.—*Medicine*.

RECENT PUBLICATIONS.

Lessons in Elementary Botany for Secondary Schools.

—Thomas H. Macbride. Boston, Allyn and Bacon, 1896 pp. 233.

Elements of Botany.—J. Y. Bergen, Boston, U. S. A. and London. Ginn & Co., Part. I., pp. 275 and viii. pt. II. pp. 57.

If one can judge from the number of text books on botany issued during the last few years in this country, the study must have a larger share of attention in our high schools and colleges than formerly. Two small books have recently appeared, both from teachers of experience. Prof. Macbride's book is divided up into fifty-four lessons, beginning with buds and their arrangements, stem arrangements, structure and kinds, roots, leaves, inflorescence, flowers, fruit and seed, then special plants, such as wake-robin, maple, buttercups and wind flowers, dandelions, rye, blue grass, ferns, mosses, fungi, and an outline of the vegetable kingdom. The book as the author says cannot be used by the teacher unless he is equipped with a good general knowledge of botany and the flora of his own immediate locality. Prof. Macbride has adopted the plan that pupils should be directed to study plants rather than the book. Admirable indeed, in fact no one should use any of the numerous text books without the plants to illustrate structure. He insists too that drawings should be made. We commend the suggestion that "these drawings however, should not be permitted to supplant full and accurate descriptions of the material studied, inasmuch as the development of ability to describe accurately is one object to be kept

in view." A student taking a course in this work, under the guidance of a good teacher ought to have a fair knowledge of pollination, the structure and relationships of plants. The numerous questions asked ought to make the student think rather than take statements for granted. It ought certainly to train the student's power of observation, and this after all, for most students, is the most valuable part in a study of natural history.

The Bergen book begins with seed and germination, parts of a seedling, storage of nourishment in the seed, roots, stem, structure of stem, buds, leaves, leaf arrangements, minute structure of leaves and functions, protoplasm and its properties, inflorescence, and plan structure of the flower, nature of floral organs, fertilization, fruit, struggle for existence, classification of plants and types of flower plants.

The work is admirably planned. The work outlined consists of experiments as well as giving reasons for observed phenomena.

Under seed and its germination, squash seed is first taken up with reference to germination, then an examination of general character. In experiment (1), emphasis is laid on whether light assists germination or retards it; in experiment (2), temperature is considered; in experiment (3) relation of water to germination; in experiment (4) relation of air to germination.

The work combines histology, physiology and morphology. The chapter on flowers takes up pollination. We believe however that the author should have used the word pollination in place of insect fertilization, and wind fertilization. The chapter on fruits discusses dissemination with pertinent questions as to why and how plants are disseminated. We hope when a second edition is called for, that the author will place the index and glossary at the end of the volume. As it is the index and glossary of part I immediately precede part II. There can be little use for part II, Key and Flora, which only embraces a few of the commonest spring flowers of the northern and middle states. These partial floras are always unsatisfactory as one is sure to find, in a short time, plants that are not represented. The book is however a commendable one in other respects and will prove valuable for high schools and smaller colleges.

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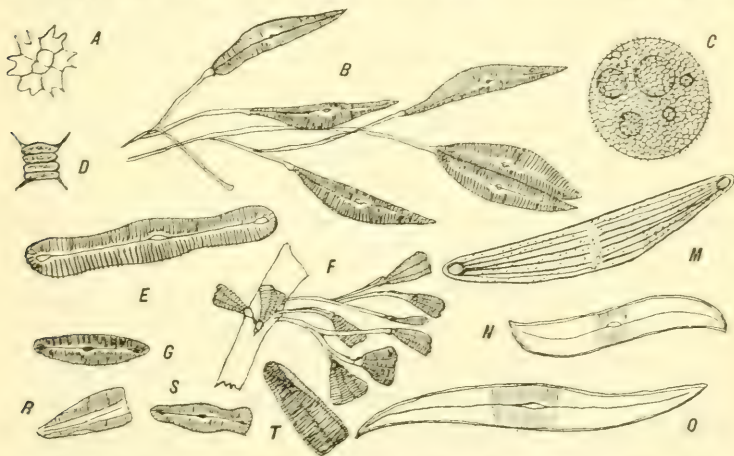
NEW SERIES.

Objects Seen Under the Microscope.

By CHRYSANTHEMUM.

XXXI.—DIATOMS, DESMIDS AND FRESH-WATER ALGÆ.

Diatoms, desmids and fresh-water algæ are among the lowest forms of minute aquatic plants. The diatoms and desmids closely resemble each other and are formed of a single cell. These cells vary greatly in structure and beauty, and furnish some of the most interesting objects



which the young observer meets in his study of pond life.

Desmids are always found in the sweetest and clearest water. They are usually green in color and move with a slow stately movement in one direction. The sac which holds the desmid may be torn or broken, and the jelly-like coloring matter forced out, leaving the edges of the sac ragged.

The diatoms when alive are usually brown and move

with a quick or jerky motion. A form may go half across the field in one direction, and then suddenly start off in another. Diatoms are found in both fresh and salt water; in fact, in almost any depression which contains water. The cell-wall is hard and brittle and is broken with difficulty, while the edges are sharp and clear cut. A cell may break into several pieces but without showing ragged edges. Diatoms are not only found alive, but many of them are fossil. They can be heated red hot or boiled in acids and still retain their beautiful markings. Indeed, in order to study them thoroughly and intelligently, they should be so treated. Not only this, but it takes the highest powers of magnification, the nicest apparatus, and the most skillful manipulation to bring out these features and to reveal their true structure. *Pleurosigma angulatum*, a salt water form, is often used to test the power of lenses. But this need not deter us from learning their forms and some of their peculiarities. We can find enough in this to interest ourselves and our friends for many evenings.

A diatom is formed much like a pill-box, it consists of two parts or valves, one corresponding to the box, the other to the cover, and they fit one over the other in much the same way. In looking at them, sometimes the front of the diatom is seen. This corresponds to the edge of the pill-box, and then it will have quite a different appearance from that presented when the top or bottom is shown. By tapping the cover-glass the diatom will usually roll over. Diatoms sometimes secrete a stem of their own, a desmid never does this. The diatoms grow on the ends of the stems, which branch and look like microscopic trees. These trees attach themselves to other plants. A good way to collect them is to take a small bit of some fine-leaved aquatic plant and with the side of the dissecting needle gently scrape the leaves,

apply a cover-glass and sufficient water to exclude the air, being careful to admit no more. Diatoms and sometimes desmids and algæ are found in this way.

Algæ are seldom found in deep water, but in pools and slowly running streams. They most often attach themselves to plants, sticks or stones. They are usually green but may be brown or purple and are surrounded by a jelly-like substance. A form quite common is *Scenedesmus quadricauda* (fig. *d*), which consists of four green cells attached by their long sides and having spines projecting from the four corners. *Pediastrum granulatum* (fig. *a*) consists of a disk having marginal teeth arranged in twos and containing six or eight green cells separated by colorless bands. Figure *a* also shows an alga.

All the species of the desmid *Closterium* are more or less crescent shaped, and are usually green. Each end often contains a clear vacuole in which many small dark particles may be seen swarming. *Closterium linula*, (fig. *m*) has the ends rounded and containing vacuoles.

It also shows the protoptasmic movement between the cell-wall and the coloring matter. It has dark longitudinal bands.

Volvox, another desmid, is a small sphere which is continually revolving. When examined under a high power, it is seen to be studded with points, each point having two cilia which are in constant motion. It is this which causes the revolutions. Dark green balls are sometimes seen inside the globe. These are young plants and when matured the mother plant bursts and they escape. *Volvox globator* is represented in figure *c*. *Cocconema lanceolatum* (fig. *b*) illustrates a branched diatom with the frustule on the end of the stem. The frustules often float free and have a median longitudinal line with a nodule in the center and at each end. *Gomphonema acuminata* (fig. *t*) is another branched form. The frustules are wedge-shaped with the narrowest edges attached to

the stem. Figures *r*, *s*, and *t*, show single frustules of the same plant floating freely and reveal different markings and positions. *Pinnularia major* (fig. *e*) is a common diatom. It has three nodules, one in the centre and one at either end. The ribs are large and conspicuous. *Pinnularia viridis* (fig. *g*) has the sides of the valves more convex than *Pinnularia major*, and is smaller and, although green by name, it is brown in color.

Figures *n* and *o* represent two different forms of *Pleurosigma*. This genus may be recognized by its beautiful curvature, resembling the letter S (the word *Pleurosigma* means **S**-shaped). It has a line extending lengthwise with a nodule in the center. The lines on the striated valves are quite close together and difficult to see except with a high power objective of good construction.

National Science Club.

The second annual meeting of the National Science Club was held Jan. 2—3, 1896, in the Science Reading rooms and hall of the National Museum at Washington, D. C. The object of this club is to create and increase an interest in science among the women of our land and it has in its membership many of the most intelligent scientific students and specialists. The following are the titles of some of the papers read at the meeting :

Lake studies by the President, Mrs. R. S. Eigenman, Bloomington, Ind. (Illustrated with lantern slides.)

Sense organs of *Lumbricus agricola*, Miss F. E. Langdon, Michigan University.

Fermentation in Bread, Growth of Plants, Miss K. E. Golden, Purdue University.

Vitality of Plants, Mrs. E. S. Bladen, Philadelphia, Pa.

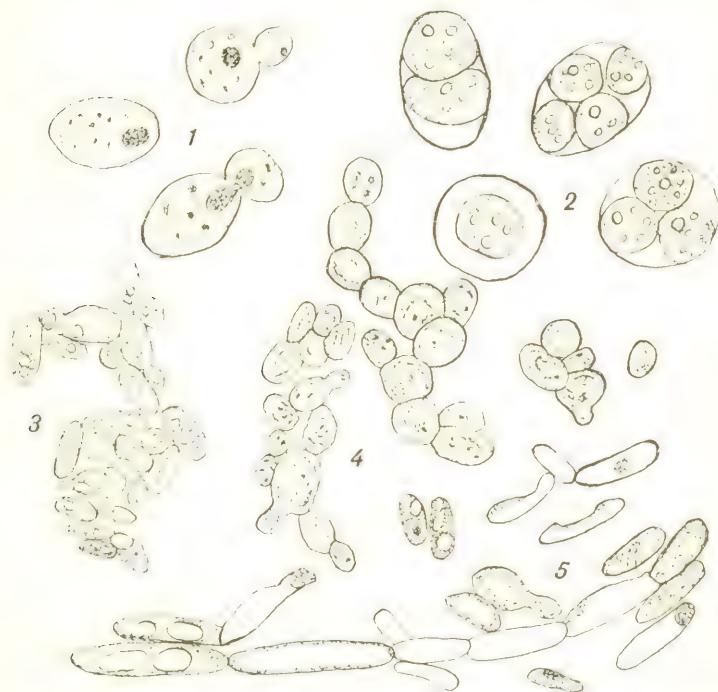
The Duty of the Women of the State to its Public Schools and Universities, J. H. Smith, M. D.

Geology of Waverly, N. Y., Miss M. B. Shepard, Waverly, N. J.

Quincy Granite of Massachusetts, Miss A. H. Gardner, Boston, Mass.

The Trees, Our Friends, Miss H. B. Bailey, Providence, R. I.

The Beauties and Mysteries of Nature as revealed by



the Microscope, Miss M. A. Booth. (Illustrated by lantern slides.)

Yellow Fringed Orchis, Miss E. J. Hasbrouck, Brooklyn, N. Y.

Adaptation of Seeds and Fruits for Dissemination, Mrs. M. F. Boynton, Lockport, N. Y.

Common Orchids of N. W. Mass., Miss D. A. Radlo, North Adams, Mass.

Any lady interested in science and wishing to obtain further information concerning this club can do so by addressing the secretary, Mrs. Laura O. Talbott, 927 P. st., Washington, D. C.

The paper on the Fermentation in Bread by Miss K. E. Golden was published in the February number of this journal and the illustration on the preceding page should have accompanied it.

Figs. 1—4 are *S. cerevisiæ* in its different stages. Fig. 1 shows the nucleus; fig. 2, ascospore; fig. 5. *S. pastorianus*.

Immunity from Cholera and Other Infectious Diseases.

M. J. ROSENAU, M. D.

SAN FRANCISCO, CAL.

[Report of an Address before the San Francisco Microscopical Society.]

A quarantine station has recently been established by the U. S. Marine Hospital service on Angel Island in San Francisco harbor. The immediate cause of the establishment of this station was the cholera scare in Honolulu a few weeks ago, although the necessity for it is liable to arise at any time, exposed as we are to the importation of epidemic and infectious diseases from Central and South American, Chinese, Japanese or Pacific island ports.

Five years ago, when I was at the Hygienic Institute, Berlin, the whole subject was exhausted in a talk of half an hour. Now the literature is very voluminous, and investigations are being made by specialists in every civilized country. Some of the lower animals are completely immune to certain diseases peculiar to man, while certain other animals are extremely susceptible to the toxins when injected into the system. Thus the germs of cholera and typhoid fever have no effect on the lower animals, while guinea pigs and some other animals may be

destroyed by cultures from diphtheria. On the other hand, rats and mice are completely immune against the toxin of diphtheria.

Acquired immunity usually follows a single attack of most eruptive diseases, but not of erysipelas or diphtheria. The whole subject of acquired immunity was opened up by Pasteur's work in 1870 in chicken cholera. Antitoxin in the blood plays the all-important role of furnishing immunity. Just how and why the blood of some animals is naturally immune may never be known. It has been thought that the acidity or alkalinity of blood may furnish a clew, but thus far investigators have not felt like hazarding an opinion. The resisting power of certain animal blood is something marvelous, when it is remembered that cholera toxin is 260 times stronger than strychnine.

One of the most valuable discoveries of recent years, at a time when so many thousands are keenly alert to new methods and new theories, is the discovery and successful use of antitoxin in epidemics of diphtheria. During the recent epidemic of that disease in Washington, Dr. Rosenau had charge of the diphtheria hospital, and consequently nearly every recorded case came under his professional care or immediate notice. The antitoxin treatment was used in every case, and with most encouraging results. To render the patient immune, or to neutralize the effects of the disease, it is necessary that the case be taken in its early stages, and that it should be free from complications with other or kindred ailments. When treated under such favorable conditions relief was obtained in nearly every case.

The mode of preparation of antitoxin has been made public. A healthy horse is injected with the toxin of diphtheria every few days for a period of one or two months, or until no reaction follows. The blood is then drawn, from the serum of which the antitoxin is made.

Why There are no Baccillariaceæ in the Chalk.

By ARTHUR M. EDWARDS, M. D.

NEWARK, N. J.

It is accounted for now why the shells of Bacillariaceæ are not present in the chalk. Of course many times chalk has been searched for Bacillariaceæ, Diatoms, but always without success. Radiolaria have been looked for until lately unsuccessfully. Sponges were seen rarely and flint, which was suspected to have been sponges likewise, were common. But now a paper by Messrs. Hill and Jukes-Browne, on the occurrence of Radiolaria in chalk solves the problem. The chalk was commonly acted upon by acids, hydrochloric or nitric acid. It was supposed that all calcareous matter would be dissolved and siliceous left. Forgetting that the silica was present in the shells of organic beings, and also that the silica was present as colloid silica, which is readily soluble in ordinary water, as crystalline silica is not. Messrs. Hill and Jukes-Browne were surprised to find the variety of the shells of Radiolaria in the chalk of the upper Cretaceous age, seeing that they are not uncommon in the lower Cretaceous rocks, and also they have been found in beds of the Jurassic age. As they say it will be seen that one cause of their rarity is undoubtedly the facility with which the siliceous skeletons of Polycistina disappear when they are embedded in rocks which contain a large proportion of carbonate of lime. They examined several hundred slides cut from sections of all the various divisions of the chalk, from many different localities, but nothing ever presented itself in any of these which was unmistakably a test of shell of a Radiolaria. This was several years ago. Then they examined some of the Barbados rock, the Infusorial rock as it is known, which has such beautiful Diatoms in it with Polycistina, Radiolaria also. This rock was siliceo-calcareous, that is to say it had

silica and lime in it. Happening recently to examine some slides of English Upper Cretaceous, some Melbourn rock chalk, they were struck with the resemblance of the spherical bodies in it to the general appearance presented by calcified and semi-destroyed Radiolaria in some of the Barbados rocks. Then they confirmed these spherical bodies to be Radiolaria. They submitted some of the slides to Dr. Hinde, the well-known geologist, and he confirmed their observation and thought the spherical bodies were Radiolaria if they were not Bacillariaceæ, *Coscinodiscus*, but those were not spherical but circular.

The examination of the spherical bodies showed the fading of the spheres away into calcite, gradually sometimes granular and sometimes crystalline the silica being removed and replaced by carbonate of lime. This would occur with colloid silica and not with crystalline silica. From this they reasoned that the Radiolaria were removed and replaced by casts of calcite, and why may not Diatoms also be removed and replaced by the casts of carbonate of lime which in turn would be dissolved by the acids used to clean the earth. It seems reasonable. Remember that the shells of Diatoms are not crystalline silica, which is insoluble, but colloid silica which is readily soluble in natural water. They are also made up of clay, silicate of aluminium which is also soluble and cellulose, also readily soluble. In Infusorial earth the shells of Diatoms are made of clay.

Botany at Cornell.—Associate Professor G. F. Atkinson has been made Professor of Botany. Prof. W. W. Rowlee has become the first assistant professor. E. J. Durand and K. M. Wiegand are instructors. In accordance with the rearrangement the following courses will be given the coming year.

I. Comparative Morphology and Embryology. Mycology and Algology by Prof. Atkinson and Instructor Durand.

II. Comparative Histology, Systematic Botany and Dendrology by Prof. Rowlee and Instructor Wiegand.

List of Microscopes and Exhibits.

BY THE NEW BRITAIN SCIENTIFIC ASSOCIATION.

November 19, 1895.

1. With Zentmayer's Army Hospital—(1) Leaf of Fuchsia, showing Raphides and Spiral Cells. (2) Seed of *Paulownia imperialis*. (3) Pollen, Cotton.—Rev. I. F. Stidham.

2. With Zentmayer's Histological—(1) Leaf of Nettle, showing Stinging Hairs. (2) Seed of Chickweed. (3.) Pollen Sunflower. Rev. I. F. Stidham.

3. With Wales' New Working—(1) Stellate Hairs on leaf of *Deutzia scabra*. (2) Fructification of fern. (3) Pollen, Japan Lily—Rev. I. F. Stidham.

4. With Bausch & Lomb's Student—(1) Louse from Pig. (2) Palate of Periwinkle. (3) Pigeon-post film—W. A. House.

5. With Bausch & Lomb's Library—(1) Louse from Human Head. (2) Palate of *Fulgar carica*. (3) Photographs of the Moon—T. E. Hall.

6. With Bausch & Lomb's Family—(1) Parasite from Fly. (2) Palate of common Slug. (3) Photograph, Niagara Falls—F. A. Pelton.

7. With F. Leitz—(1) Type Slide, 50 Diatoms. (2) Foraminifera from Ireland. (3) Fibres of Italian Flax—William R. Stone.

8. With Bausch & Lomb's Student—(1) Diatoms, *Arachnoidiscus* Ehr. in situ. (2) *Polycistina* from Barbados. (3) Fibres of Cotton—Wm. R. Stone.

9. With Bausch & Lomb's Investigator—(1) Fossil Diatoms, New Britain deposit. (2) *Globigerina* Ooze from 1950 fathoms depth. (3) Fibres of Silk and Wool—William R. Stone.

10. With Beck's New National— Circulation of Blood in Foot of Frog—Miss Caroline T. Robbins.

11. With F. Leitz—(1) Section of Scalp. (2) Section of Skin, showing Pores and Glands. (3) Section of Tooth—Miss Caroline T. Robbins.

12. With Zentmayer's Histological—(1) Wing of Butterfly. (2) Vase, and Bouquet made of Butterfly Scales and Diatoms. (3) Rosette 240 Diatoms etc.—Miss Mary E. Goodrich.

13. With Bausch & Lomb's Investigator—(1) Section of Spine of *Echinus*. (2) Section of Coal, showing Fossils. (3) Spiracle of *Dytiscus*—Prof. J. H. Peck.

14. With French—(1) Skin of Holothurian. (2) Crystal bearing Mica. (3) Wings of Honey Bee—Prof. J. H. Peck.

15. With Bausch & Lomb's Family—(1) Type slide of *Holothuridae*. (2) Section of Pitchstone (3) Gizzard of Cricket—C. W. Marshall.

16. With Bausch & Lomb's Model—(1) Spines of Starfish. (2) Gold Sand from California. (3) Fern Crystals of Silver.—Joseph Sayers.

17. With Bausch & Lomb's Library—(1) Section of Fossil coniferous Wood. (2) Longitudinal section of mahogany. (3) Longitudinal section of Pine—Joseph Sayers.

18. With French—(1) Eye of Fly. (2) Proboscis of Butterfly. 3. Plant Louse—Walter L. Williams.

19. With Acme, No. 4—(1) Section of Cartilage. (2) Blood Corpuscles, Amphiuma. (3) Section showing structure of Muscle—Dr. G. J. Holmes.

20. With Bausch & Lomb's Harvard—(1) Section showing Ossification of Cartilage. (2) Blood Corpuscles, Alligator. (3) Section showing structure of Nerve—Dr. G. J. Holmes.

21. With Bausch & Lomb's Model—(1) Section of Bone. (2) Blood Corpuscles, Human. (3) Section showing structure of Brain—Dr. G. J. Holmes.

22. With Bausch & Lomb's Universal—(1) Mineral section, Wavellite, with Polarized Light. (2) Japanese Sketch, made of Butterfly Scales. (3) Skin of Sole—A. L. Wiard.

23. With Zentmayer's Army Hospital—(1) Mineral section, Porphyritic Basalt, with Polarized Light. (2) Section of Chalcedony, with Polarized Light. (3) Young Oysters—M. S. Wiard.

24. With French—(1) Transverse section of stem of Lime. (2) Transverse section of Petiole of Pond Lilly. (3) Young Starfish—M. S. Wiard.

25. With Wales' New Working—Living objects in Water—A. N. Lewis.

26. With Wales' New Working—Living objects in Water—C. M. Burgess.

EDITORIAL.

Antony Van Leeuwenhoek and Vivisection.—In a defense of vivisection recently put forth by a committee of scientific men occurs the following narrative: Two hundred years ago there lived at Delft, Holland, this well-to-do Dutchman. He had been a dry-goods clerk in his youth and he had no learning or professional training. He took to making and polishing, for his own use, very small and very strong magnifying glasses, because he was full of scientific curiosity. With them he examined the most miscellaneous objects—among others, particles from the surface of his teeth and from ditch water. He discovered therein living things and described them. He became famous and princes came to look through his little glasses. It was he who first discovered bacteria or microbes. The physicians began to guess that disease might be due to the ravages of these forms but as no proof was forth-coming they abandoned the idea for the time. A century later bacteria came to be more studied. The microscope was improved. Chemistry had advanced as well as all other means of scientific investigation. The idea that bacteria might cause disease again came to the front and was carried to demonstration by medical men and

biologists. The proof that many diseases are caused by bacteria was obtained by vivisection. It consisted in inoculating animals with the specific microbe in question to the exclusion of all others and noting that the animals took the disease and often died of it. Among the results of knowledge gained in this manner it may be remembered that the prevention of cholera has been made more certain and that great numbers of patients especially children have been saved by the anti-toxine treatment of diphtheria. Every child thus saved owes it not merely to medicine but to biology and to the microscope; not only to the vivisections of Klebs, Loeffler, Koch and Pasteur but to the old lens-polisher of Delft.

Liverpool Meeting.—The British Association for the Advancement of Science will meet at Liverpool, September 16-23, 1896. There will be an excursion to the Isle of Man in order to see the geology of the island. This includes igneous and glacial formations and fossil-bearing limestone of carboniferous age. Prehistoric remains are note-worthy. Marine fauna and flora are abundant.

QUESTIONS ANSWERED.

NOTE.—*Dr. S. G. Shanks, of Albany, N. Y., kindly consents to receive all sorts of questions relating to microscopy, whether asked by professionals or amateurs. Persons of all grades of experience, from the beginner upward, are welcome to the benefits of this department. The questions are numbered for future reference.*

237 *In the abstract, on the best method of sharpening a microtome knife in the November number of the A. M. M. J., two substances are mentioned: Vienna Chalk and Diamantine. Where can I get them and what the cost? T. B. D.*

Diamantine, No. 1, for cutting, small bottles, 25 cents.

Vienna Lime, " " 15 "

For sale by Montgomery & Co., No. 105 Fulton St. N. Y. and probably by any other large concern in the watch tool trade.

Diamantine is mixed with a little sperm oil but used nearly "dry" on a plane glass surface. No. 1, cuts more freely than No. 2. The latter is used for polishing only.

Vienna Lime is used with water, or better with alcohol, on a plane block tin or box-wood surface. It should be mixed in

small quantities, when used, and the stock bottles kept tightly corked.

238 *Since the concave mirror gives far better results than the plane one, what is its use? Wistaria.*

When properly focussed upon the object the concave mirror acts as a simple condenser, and is more useful with the higher objective whose smaller lenses require a brighter light for good definition, the plane mirror is generally used when a bull's-eye lens or other condenser of light is employed, the plane surface being used to direct the light into the objective. If, in this case, the concave mirror were employed it would increase the aberration of the condenser as well as those of the objective, and poor definition would result.

PRACTICAL SUGGESTIONS.

By L. A. WILLSON,

CLEVELAND, OHIO.

A Home-Made Turn-Table.—The following is primitive and was used before the advent of turn-tables, but for one who is not prepared to purchase a store turn-table it will answer fairly well.

A flat piece of board of the proper size will answer for the table. On this table place two circular wheels secured in place by central screws. On one disk place spring clips of brass to hold a slide; on the other wheel fix a handle. Connect the wheels by an endless band. To hold the band the wheel should be grooved.

Tongues of Mollusca.—These tongues, or palates may be obtained by expert dissection. An easier method, however, is to boil the animal in caustic potash until all the soft parts have disappeared. The tongue, or palate will then be found at the bottom of the vessel and may then be separated with dissecting needles. When properly prepared they are beautiful objects for the polariscope.

The Itch Insect—Acarus Scabiei.—This insect is very interesting and a rare object in a microscopical cabinet. To find

the itch insect operator must examine carefully the parts surrounding each pustule, when a red line or spot communicating with it will be seen: this part and not the pustule must be probed with a fine pointed instrument. The operator must not be disappointed by repeated failures.

Demodex Folliculorum.—This is a parasite generally described as being found in the sebaceous follicles of human beings. However, it may generally be very easily found in the cerumen of the ear. To see the parasite alive place a little of of the cerumen on a slide, cover with castor oil and examine with a quarter inch objective. Nothing answers as well as castor oil for the examination of the little parasites. Glycerine shrinks and kills them and some media render them too transparent.

SCIENCE-GOSSIP.

Desmids.—One of the peculiarities of desmids is their exceeding symmetry, each half of the cell (for though apparently double, it is really single, as is shown if a puncture is made, the whole cell-contents being emptied) being identical, the same number of starch-grains, if they exist, being shared equally in the same relative places (the same with chlorophyll, etc.); this bilateral arrangement is, if I may use the term, very animal-like.

These organisms are best examined in their fresh state. On the slide, the cell-walls show most distinctly the interior contents, however, are not so clear. This, perhaps, is unavoidable in mounted specimens.—*The International Journal of Microscopy.*

Fowls and Infection.—The transmission of diphtheria to human beings from fowls is affirmed by Gerhardt, Debrie, Menard, Schrevens, and other writers. Cole reports a case in Jacksonville, Ill., where a sick chicken was taken into the house and fondled by a child two and one-half years old. Four days later the child was taken with diphtheria and died. There were no other cases of the disease in the neighborhood, and the affected chicken was the only source of infection.

It is evident from the limited investigations made that diph-

theria prevails among fowls to a larger extent than is supposed. Their habits of living, running at random over wide ranges, picking food from garbage and manure piles, render them especially liable to infection. It is a common practice to bring sick chickens into the house for treatment, where children are permitted to handle them, and it is evident this disease is spread in this manner more extensively than has been supposed, and that many cases of mysterious sources of infection of children could be traced to infected poultry.—*Iowa Health Bulletin*.

RECENT PUBLICATIONS.

Washington ; or the Revolution. An Historical Drama. By Ethan Allen. In two parts ; both ready. Published by F. Tenneyson Neely, Chicago and New York. Each part, paper, 50 cents; cloth, \$1.50.

It was Solomon who said, "There is no new thing under the sun." Had he lived in our day, he never would have said it. There is in literature something that in the wide world was never known before. Mr. Ethan Allen, of the New York Bar, has found time to step aside from professional duties to dramatize the tragic story of the struggle for American Independence. Where is the record that such a thing in regard to any epoch was ever done until this day ? Nowhere. Incidents in history have been clothed in dramatic form. Shakespeare did this. But around one central historic figure are waves of fiction which drown the chief character for all historical purposes. Shakespeare called upon history to aid his romance. Allen called upon romance to aid in the full and correct recital of history. The central purpose of Shakespeare was to amuse an audience with a fiction diluted and spiced with historic names. The central purpose of Allen has been to teach the world in dramatic form, the story of the American Revolution, with only enough of fiction to tie together the firm strands of historic truth. The same comparison may be made with any writer since Greece was classic and supreme. Hence this effort of Mr. Allen is novel, unique and wholly new.

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THE MICROSCOPE

APRIL, 1896.

NUMBER 40

NEW SERIES.

Formalin as a Hardening Agent for Nerve Tissues.

WILLIAM C. KRAUSS, M. D.,

BUFFALO, N. Y.

[Member of the American Microscopical Society.]

Formol, Formalin, or Formaldehyde was discovered by A. W. Hoffman in 1863 while passing wood spirit and air over a red-hot platinum spiral. If the vapor is brought into water to its point of saturation, a forty per cent solution of formaldehyde is obtained, which has long been known under the name of formol. That Formalin possessed antiseptic as well as hardening powers we owe to the investigations of Dr. F. Blum, and these facts induced the elder Blum to make an extended series of investigations in the hardening of animal and vegetable tissues in the Senckenbergischen Institute at Frankfort, Germany. His preliminary report was published in the *Zoologischer Anzeiger*, 1893, No. 434, and a more detailed report in the *Berichte über die Senckenbergische Naturforscher Gesellschaft*, 1894, p. 195. Here he details his experience, which in brief is as follows: Several human embryos were finely preserved in formol diluted with ten to twenty parts of water. Small embryos with amnion intact were preserved and the amniotic fluid remained transparent, so that the structural parts of the fœtus and the umbilical cord were recognizable. The mouse, hamster, and porpoise, were nicely preserved, the hair firmly in

place and the eyes in better condition than under the use of alcohol. Reptiles, fishes and amphibians were nicely hardened in one to ten, one to twenty, or one to thirty, solutions according to the size of the object. The fishes retained in great part their color, while the slime and mucus covering them was rendered transparent. Of the invertebrates, snails, jelly fishes, insects, spiders, etc., all were well preserved.

Of the various animal tissues, muscles and the brain were quickly hardened, retaining the coloring matter of the blood in the muscles, while in the brain the differentiation between the white and gray matter was very evident. Fruits, flowers and vegetables of various kinds were equally successfully preserved, the coloring matter very little if at all impaired. Blum's conclusions regarding the hardening of animal tissues may be summed up as follows :

Animal objects are hardened with shrinking, and without losing their microscopic structure or staining properties.

The natural form and color are preserved.

The eye remains much clearer than in alcohol.

The mucus of slime-producing animals is not coagulated and remains transparent.

The coloring matter of blood in tissues apparently disappeared, but may be quickly restored by a high per cent alcohol.

These experiments of Blum were pathmaking and were quickly followed by those of Born, Pintner, Kruckmann, Kenyon, Sadebeck, Mayers, and others with seemingly favorable results as regards the preserving and hardening powers of this compound. Besides these qualities it was especially valuable because of its being non-poisonous, non-combustible, of a low freezing point, and, what to scientists is quite a serious question, very cheap.

My attention was directed to this substance about one year ago, through experiments made at the Laboratory of the Erie County Hospital by my interne, Dr. Helvie.

Various tissues, as liver, spleen, placenta, lungs, heart, muscles, and other tissues and organs were satisfactorily hardened and preserved. Especially gratifying were the results obtained with the umbilical cord, and other myxomatous tissues. Instead of shrivelling up and becoming opaque as occurs when alcohol is employed, the cord retained its normal size, was transparent and hardened to such a degree that sections were easily and perfectly cut with microtome. The intestines were greatly shrivelled during hardening, but otherwise were a success.

These results induced me to try its virtues upon the brain and spinal cord, and especially to find the earliest time when a spinal cord so hardened could be imbedded in celloidin and sections cut for staining and mounting. A spinal cord which to all appearance was normal was cut in pieces about one centimeter long and placed, sections of the cervical, thoracic and lumbar regions in bottles containing a five per cent solution, ten per cent, twenty per cent and twenty-five per cent of Formalin. At the end of seven days a section of the cord was taken from each of these solutions and imbedded in celloidin, then placed on the microtome. The cord was evidently too imperfectly hardened, as no good cuts were obtained. At the end of fourteen days the same procedure was followed, likewise on the twenty-first day and twenty-eighth days. From each of these intervals excellent cuts were obtained; the cord retained its external contour and appearance, but the differentiation between the white and the gray matter was not as well marked as when alcohol is used. These sections took the carmine stains nicely, but less so the nigrosin, Pal and Weigert stains. The most serious action of the formalin on all of these sec-

tions was a contraction, evidently of the neuroglia in various regions of the cord, especially of the white matter resulting in the formation of open spaces or cavities. In the sections hardened in the 10 per cent solution these cavities were so large as to destroy completely the slides for microscopical purposes. In the 15 per cent cord, the cavities were much smaller, but far more numerous, and the dorsal white columnus looked like a honey comb or sieve. This action of the formalin was manifested in every section examined and is therefore not of accidental, but of regular occurrence. The drawback of the formalin in preventing the employment of the Pal and Weigert methods of staining has been successfully overcome by Marcus, who after hardening the cord for from two to four weeks in a one-half per cent solution of Formalin, places small portions one-half cm. thick in Muller's fluid in a brood oven for seven days at a temperature of 37° C. They are then dehydrated, imbedded, and the cuts again placed in Muller's fluid, for from two to seven days in a brood oven, quickly washed in alcohol then transferred into the Weigert stain.

The action of the formalin on the ganglion cells is a happy one, swelling them and rendering their nuclei susceptible to very intense staining.

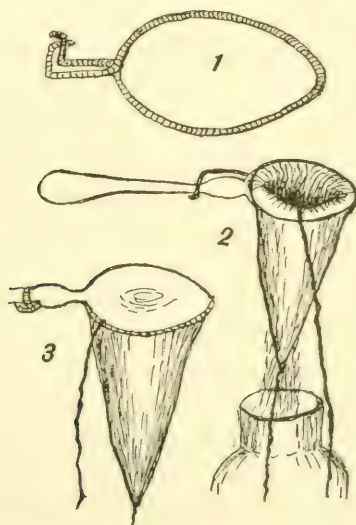
The action of formalin on the brain has given very fine results. Born succeeded in hardening the entire brain very quickly for demonstrations, also small particles for microscopical purposes. I have been equally successful and have some excellent specimens, nicely hardened. I have not as yet tried any of the staining methods on brains thus hardened and cannot state what the results would be, although I have some specimens under way. From my experience with Formalin I can greatly recommend it, for the hardening of the various organs and tissues for macroscopic as well as microscopic purposes, but would still cling to the Muller's solution

for hardening the spinal cord, even if the time required for hardening be much longer than when Formalin is used.

Simple Apparatus for Gathering Microscopic Objects.

BY G. M. HOPKINS.

One of the difficulties experienced by a beginner in microscopy is the finding and gathering of objects for examination. As a rule, cumbersome apparatus has been used. The conventional apparatus consist of a staff, to which are added a knife, a spoon, a hook and a net; but a



great deal can be accomplished with far less apparatus than this.

The engravings illustrate a simple device, by means of which the amateur microscopist can supply himself with as much material as may be required. It consists of an ordinary tea or desert spoon, and a wire loop of suitable size, to extend around the bowl of the spoon, having the

ends of the wires bent at right angles, and in opposite directions. To the loop is fitted a conical cheese-cloth bag, and to the bottom of the bag, upon the outside, is attached a strong string, which extends over the top and down to the bottom in the inside, where it is again fastened. The spoon is inserted between the bent end of the loop and turned, and the point of the bowl is slipped through the loop.

The instrument is used in the manner shown in Fig. 85, that is to say: it is scraped along the surface of objects submerged in the water, the water passing through the cloth, and the objects being retained by the conical bag. When a quantity of material has accumulated, the bag is turned inside out by pulling the string, and the pointed end of the bag is dipped a number of times in water contained in a wide-mouthed bottle. The operation of collecting is then repeated. The objects thus washed from the bag are retained in the bottle for examination.

The common method of examining small objects of this kind is to place a drop of water containing some of the objects upon a glass slide by means of a drop-tube, then to apply a cover-glass, and remove the surplus water by the application of a piece of blotting paper. This answers very well for the smaller objects, but larger ones must be examined in a tank or animalcule trough, which may be obtained at a trifling cost of all opticians. To vary the thickness of the body of water contained in the tank, one or more glass slips are inserted behind the objects.—*Scientific American*.

Evils of the Microscope.—“Johnnie, here you are at breakfast with your face and hands unwashed!”

“I know, mamma, I saw the little things that live in water through papa’s little microscope last evening and I’m not going to have them crawlin’ over my face with their funny little legs.”—*Demorest’s Magazine*.

Mounting in Phosphorus, Etc.

BY ARTHUR M. EDWARDS, M. D.

NEWARK, N. J.

Ever since I began to use Gum Thus for mounting microscopic specimens, and the mounting is easy now, doing away entirely with the sticky Canada Balsam, which has not the refractive index of Gum Thus, I have been after some mode of putting up the various specimens I have in solid bodies. Lead chromate has a refractive index of 2.50 to 2.97. It is therefore the best object we have for microscopic specimens. Phosphorus has an index of 2.224 and comes near to lead chromate.

I have succeeded in preparing both of these, and will detail exactly how I make them. Premising that the preparations are not patented and can therefore be made by anyone, and I wish they would be made and reported on, for I feel that we have here a means of mounting easy and cleanly and goodly therefore, for the refractive index is high and bacillariaceæ, for instance, show nicely when it is used. Any kind of object shows well and we have a medium here attached to the modern immersion objective of oil of cedar, chromate of lead first. I first prepare the solution of Gum Thus in alcohol. Gum Thus is common and sells at about five cents a pound. A lot, about a half a pound, is placed in a wide mouthed bottle and alcohol, the common spirit, is poured on it. It is left to dissolve, being shaken from time to time. I find placing it in the sun in warm weather or otherwise heating it will hasten the solution, after a day or so a saturated solution of Gum Thus in alcohol is obtained. It is labeled and put aside to clear by deposition. This it does in two or three days.

Lead chromate is made by acting of solution of lead acetate (sugar of lead) by means of potassium bichromate and the yellow precipitate washed until all of the

potassium acetate is removed, the yellow lead chromate washed on a filter. It is drained until it is a moist powder, not dry, and then is added to the Gum Thus solution in alcohol, in excess, and boiled by means of a water bath for about fifteen minutes. The solution is left to stand until cool and the excess of lead chromate permitted to settle. We have then the mounting material.

Preparing the phosphorus solution for mounting is done in a different way. Procure some pure phosphorus. Remember that it is inflammable, and, besides, the burns that it makes are extremely painful. It is also poisonous, so to prepare it we work with it under water handled with a forceps, not by the hand at all. Some is put into a flask and cold water added. It is then held over the flame of a lamp until the phosphorus melts. Immediately it is taken from the flame and violently shaken. At the same time cold water is added. In this way the phosphorus is broken up and concretes into fine sand-like phosphorus in particle of the sand being spherical. When it is cold, a few grains of the sand are collected by a pipette and transferred to another vessel. Here the water is nearly poured off and oil of cinnamon added in enough quantity to just cover the phosphorus. It is then heated, not boiled, and some of the phosphorus dissolves. It is then added to the solution of Gum Thus in alcohol and we have the solution of phosphorus for mounting.

Sulphur can be dissolved in the same way and quinine also. All of these make valuable mounting solutions and I hope for their introduction into microscopy, for I feel that we have here solutions of interest and shall look for the results with interest.

Louis Agassiz.—Another biography, of 620 pages, has been issued to record the life of this naturalist. This time Mr. Jules Marcou is the biographer who says that the previous lives were too eulogistic. The review of this book by *Nature*, however, is far from eulogistic of what Marcou has written. It is very spicy.

THE MICROSCOPE.

New Series, 1893.

For Naturalists, Physicians, and Druggists, and Designed to Popularize Microscopy.

Published monthly. Price \$1.00 per annum. Subscriptions should end with the year. The old series, consisting of 12 volumes (1881-1892), ended with December, 1892. Sets of the old series cannot be furnished. All correspondence, exchanges, and books for notice should be addressed to the Microscopical Publishing Co., Washington, D. C., U. S. A.

CHARLES W. SMILEY, A. M., EDITOR.

EDITORIAL.

Preservation of Yeasts.—Hanson carries out this in using 10 per cent solutions of sugar-cane. Stock yeasts may be kept for many years without suffering any detriment. They can be propagated in beer wort and transported at pleasure. Hanson and others have sent yeasts from Copenhagen to South America, Australia and Asia in perfect condition. Those interested should get from London the English translation of Hanson's "Practical Studies in Fermentation: being contributions to the Life-history of Micro-organisms."

Sodium Fluoride as an Antiseptic.—Sodium fluoride, flurol, is said to be a valuable antiseptic, and it is a bluish-white odorless powder of saline taste. It is said to be preferable to corrosive sublimate, which is sixteen times more poisonous, and preferable to nitrate of silver, formaline and permanganate. In 1 per cent or even in half per cent solutions it acts as a powerful germicide. One of the objections to the use of corrosive sublimate is that the albumenoids are coagulated and bacteria are protected by an envelope of coagulated albumen. This is not the case with sodium fluoride.

QUESTIONS ANSWERED.

NOTE.—Dr. S. G. Shanks, of Albany, N. Y., kindly consents to receive all sorts of questions relating to microscopy, whether asked by professionals or amateurs. Persons of all grades of experience, from the beginner upward, are welcome to the benefits of this department. The questions are numbered for future reference.

Does the binocular microscope excel the monocular form in ease of vision or clearer image? Would a binocular stand at \$90.00 or \$98.00, be too cheap to give satisfaction? — E. N. H.

The binocular microscope is inferior to the monocular form for ease of vision and for clear images. The single image formed by the single objective is divided by the binocular prism, with a loss of light and of definition. Course objects, like sand or shells, stand out in pretty, stereoscopic relief but, good definition requires a clear, straight tube, which can be had in the binocular form by sliding back the prism in the nose piece or bottom of the tube. A binocular stand at \$90.00 ought to be satisfactory.

PRACTICAL SUGGESTIONS.

BY L. A. WILLSON,

CLEVELAND, OHIO.

How to See Trichina in Raw Pork.—We have often, in these pages suggested that the microscope, as its name implies, is for the observation of little things. A few evenings since, an amateur brought a piece of trichinous pork which he had placed on a glass slip and covered. He had placed a comparatively small piece on the slide. The trichinae were visible but were dim and hazy. Upon lifting the cover, and picking out a piece of a single muscular fibre, removing the rest of the meat; covering the particle of single fibre, and pressing it out thin with the finger on the cover, the trichinae in their cysts were plainly, clearly, and beautifully visible. Examined with a quarter-inch objective they were still plain, and all the details of the parasite could be plainly and satisfactorily observed.

The Prothallium of a Fern.—It is very interesting to view a prothallium of a fern. They may be found at the base of the plants and may be easily obtained in a green-house where ferns are cultivated. They are small, heart-shaped bodies and are interesting as they contain the archegonia and antheridia which will eventually produce a new fern. The antheridia project from the basal portion of the under surface of the prothallium. One of the interior cells becomes divided into sperm-cells, in each of which is a specially coiled spermatozoid. The archegonia are cellular projections from the anterior portion of the under surface of the prothallium. These prothallia may be dried and mounted in balsam.

Eosin Staining.—Dilute solutions of eosin, one part to one thousand of water, may be used for animal tissues. The different parts are differentiated by different tints. Sections are stained in a minute and a half. Then wash it in water acidulated slightly with acetic acid, and examine in glycerine; or, mount in balsam after the water is removed and the section is thoroughly dried.

Identification of Lichens by Measuring Spores.—Many species of lichens are outwardly very similar but may be identified by the difference in the size of their spores. Nearly all works on lichens give the sizes of the largest and smallest spores. The identification may be determined by a measurement of the spores. This is not difficult. The microscope should be provided with an eye-piece micrometer. Then let a stage-micrometer, divided by thousandths of a millimetre, be placed on the stage of the instrument and let the observer note how many of its divisions are equal to one division of the eye-piece micrometer. By this method the spores can subsequently be measured by the use of the eye-piece micrometer.

Microscopical Examination of Sputum for January.—Number of examinations made in the Battle Creek Sanitarium, 36; number of cases, 29; number of specimens in which tubercle bacilli were found, 14.

Patients whose sputum contained tubercular germs, were received from the following states: Michigan, 9; Texas, 1; Colorado 1; Iowa, 1; Mississippi, 1; Ontario, 1. Total. 14.

SCIENCE-GOSSIP.

Commercial Use of Red Pigment From Bacteria.—It is a well known fact that many bacteria produce beautiful pigments. The Chinese have long used a pigment, "Aug-Khak," for the coloring of foods. The microbe producing this color grows readily on all starch-containing substances. The rice is ground and boiled and inoculated from an older culture. In about six days an abundance of the coloring matter is produced. The organism only grows in the presence of air and in a cool damp place. To check the growth of deleterious species arsenic is added, which does not influence the pigment form.

Micro-Organisms on Coins.—The *Revue d'Hygiene* publishes an interesting account of some experiments made at the bacteriological laboratory of the Military Hospital of the Dey at Algiers. Dr. H. Vincent explains that money is specially liable to be contaminated by saliva, pus, pathological secretions, dust, and the morbid germs that may be found in dirty pockets or on dirty fingers. He does not think, however, that evidence of this danger can be easily obtained by placing dirty coins in culture broth. The investigations at the Dey Hospital were conducted in a different manner. A piece of cotton-wool about the size of a pea was dipped in water and sterilized. Pieces of wool thus prepared were seized with pincers that had been held in a flame and were gently passed over the coin to be examined. The pieces of wool were then placed in culture broths and kept in a temperature of 35° C. The product, which soon contained various micro-organisms, was sown anew in gelatine plaques so as to isolate the bacteria. In other cases it was inoculated in doses varying from one to five cubic centimeters, in the blood or under the skin of rabbits, guinea-pigs and white rats. A lengthy description of the methods employed and the results obtained is given. The number of bacteria found on the surface of coins varied very considerably, on silver and gold from four hundred and sixty to thirty-five hundred, and on copper a still larger number. To destroy many of the non-pathogenic microbes some experiments were made at a temperature of 37° C. The injection of mixed cultures from coins only produced

death or serious results in about one out of every ten inoculations. Death was sometimes rapid, with symptoms of acute septicemia. In one case tuberculosis was communicated to a rabbit by a piece of wool which had been passed over a ten-centime copper coin. In another case there was slight tetanus. There can be no doubt that germs of disease are often to be found on the surface of coins, notably the microbe of suppuration, the staphylococcus pyogenes, and the streptococcus. Nevertheless, as the experiments were repeated they proved that there were fewer infectious germs than had been anticipated.

Another series of experiments was then made which demonstrated that, though coins are often contaminated they possess in themselves antiseptic qualities which greatly reduce the risk. If pathogenic germs are placed on coins it is seen that they do not live long. The time varies according to the temperature and the nature of the metal. In a cold temperature the germs of typhoid fever and the Friedlander bacillus are killed in eighteen hours if placed on a sterilized copper or silver coin; and the pyocyanic bacillus and that of green diarrhoea in twenty-four hours. At a temperature of a pocket, about 36° C., the bacilli of typhoid fever, of blue pus, of diphtheria, and the streptococcus are destroyed in less than six hours. The bacilli of diphtheria are among the most tenacious, and in cold will live three days on silver and six days on bronze. Gold, of course, is less antiseptic, and the Eberth bacillus will live five days and that of diphtheria six days on a gold coin in a temperature of 20° C. at a damp temperature of 36° C., the destruction of the microbes is very rapid, and that is the temperature which often prevails in the pockets of clothes.—*Medical Record*.

Bacteria in Railroad Cars.—An examination of the dust of railroad cars made in Germany under the direction of the Imperial Board of Health, showed in fourth-class cars more than twelve thousand germs per meter, than in first-class cars about one-fifth this number. Some of the animals inoculated with the dust died of tuberculosis, showing the presence of this germ with the other miscellaneous microbes, of which railroad carriages, as at present managed, furnish a very large assortment.—*Modern Medicine*.

CORRESPONDENCE.

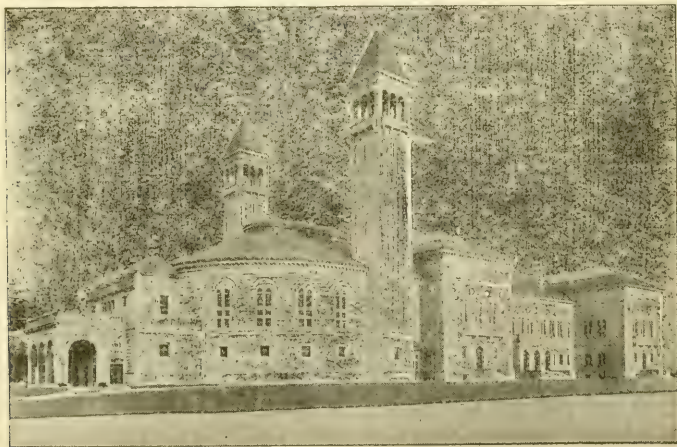
The articles in the *MICROSCOPE* by *Chrysanthemum* are just right and I hope that they will be continued through 1896.—O. E. S.—Port Townsend, Wash.

Buffalo, N. Y., March 31, 1896.

To the Members of the American Microscopical Society:

The next meeting of the Society will be held at Pittsburg, Pa., August 18, 19, 20, 1896. Our Society will be the first National Society to meet in the beautiful new Carnegie Library Building and will therefore have an additional honor bestowed upon it. The Iron City Microscopical Club is putting forth every energy to make the '96 meeting the banner meeting of the Society, and to succeed, needs the support and encouragement of every member.

We ask you, therefore, to do your share: Come to the meeting prepared to read, discuss or listen. You have at least one friend interested in Microscopy, who can be persuaded upon to join. Fill in the blanks and send them to the Secretary as soon



as possible. Mr. C. W. Smiley, 943 Massachusetts Avenue Washington, D. C., will send blanks for application.

A preliminary program will be published on July 15, 1896, and if you have anything interesting or new, communicate it to

the Society, and let others have the benefit of your work, thus showing the true scientific spirit.

WM. C. KRAUSS, M. D.,

382 Virginia Street.

Secretary.

Gents:

I have the pleasure to send you by express a cut of the famed Carnegie Library Building, where the next meeting August 18-20 is to be held.

The local committee is organized: C. C. Mellor, Chairman, Magnus Pflaum, Secretary and Treasurer, and C. G. Milnor, Chairman, Finance Committee, either of them will be glad to give members and others desiring to attend, all necessary information. As soon as sufficient arrangements are made, special announcement will be mailed to all members.

Yours truly,

MAGNUS PFLAUM.

RECENT PUBLICATIONS.

New Truths in Ophthalmology as developed by G. C. Savage, M. D., third edition. 12° square. 270 pp. 58 illustrations.

This enlarged edition appears to have been necessitated by the criticisms of Eaton, Hotz and Wilson, to meet those strictures. Three new chapters have been added. Dr. Savage thanks his critics for having in their own way aided him in presenting more clearly his views on oblique astigmatism and the oblique muscles.

There is a new chapter on treatment of insufficiency of the obliques. The development of weak ciliary muscles and the prevention of presbyopia receive generous consideration.

Dr. Savage is taking front rank among the ophthalmologists of the day and as a writer on the subject. Everyone who treats eyes ought to know something which he can tell and the book should be a text-book in college classes studying the eye.

Our notice must be brief because microscopy is not involved in his theme but we cordially commend the book to those who are interested in the technique of the subject.

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THE MICROSCOPE

MAY, 1896.

NUMBER 41

NEW SERIES

Sabella.

BY P. H. GOSSE, F. R. S.

For some time I have been keeping in a tank a specimen of that rather rare and very interesting Sabella, the *Amphitrite vesiculosa* of Montagu. It is a worm inhabiting a sort of skinny tube, much begrimmed with mud, about two inches of its length being exposed, and about as much more concealed in the sand and sediment.

A beautiful object is presented by the gill-fans of this worm. These organs are always elegant, whatever species



The Witches' Dance Around the Charmed Pot.

we may have before us, but here, in addition to the slender filaments, so delicately fringed, with their double comb-like rows of cirri, the tip of each bears a dark purple spherule. That of the anterior filament on each side is much larger than the rest, and forms a stout, globose, nearly black ball; the others diminish to about the

twelfth on each side, where they disappear. These balls are placed on the inner or upper face of the filament-stem, at the point where the pectination ceases, the stem itself being continued to a slender point beyond it, and constituting the "short hyaline appendage" of Montagu. From their great resemblance to the tentacle-eyes of the Gasteropod Mollusca, I have little doubt that these are organs of vision. If so the profusion with which the *Sabella* is furnished in this respect may account for its excessive vigilance; which is so great, that not only will the intervention of any substance between it and the light cause it to retire, but very frequently it will dart back into its tube almost as soon as I enter the room, even while I am ten feet distant.

It is not, however, to the tube nor to the worm, that I wish especially to direct the attention: yet it is necessary that I say a preliminary word about the former. Ordinarily the tubes of these worms are formed of the fine impalpable earthy matters (clay, mud, etc.) held in suspension in the sea, incorporated with a chitinous secretion from the body of the animal; and therefore the surface of the tube is always rough and opaque. But in this individual case, probably owing to the habitual stillness of the water in the vessel not holding in suspension the particles of mud that ordinarily enter into the composition of the tube, the latest-formed portion is composed of pure transparent chitine, without any perceptible earthy element. This clear terminal portion of the tube you may perceive to be occupied by a curious parasite. About twenty bodies, having a most ludicrously close resemblance to the human figure, and as closely imitating certain human motions, are seen standing erect around the mouth of the tube, now that the *Sabella* has retired into the interior, and they are incessantly bowing and tossing their arms in the most energetic manner.

As soon as you have recovered from your surprise at this strange display, we will begin to examine the performers more in detail. A slender creeping thread, irregularly crossing and anastomosing, so as to form a loose network of about three meshes in width, surrounds the margin of the sabella's tube, adhering firmly to its exterior surface, in the chitinous substance in which it seems imbedded. Here and there free buds are given off, especially from the lower edge: while from the upper threads spring the strange forms that have attracted our notice. These are spindle-shaped bodies, about one-fortieth of an inch in height, whose lower extremities are of no greater thickness than the thread from which they spring; with a head-like lobe at the summit, separated from the body by a constriction, immediately below which two lengthened arms project in a direction toward the axis of the tube.

Such is the external form of these animals, and their movements are still more extraordinary. The head-lobe of each one moves to and fro freely on the neck, the body swags from side to side, but still more vigorously backward and forward, frequently bending into an arch in either direction; while the long arms are widely expanded, tossed wildly upward, and then waved downward, as if to mimic the actions of the most tumultuous human passion.

Whenever the Sabella protrudes from its tube, these guardian forms are pushed out, and remain nearly in contact with the Annelid's body, moving but slightly; but no sooner does it retire than they begin instantly to bow forward and gesticulate as before. These movements are continued, so far as I have observed, all the time that the Sabella is retracted, and are not in any degree dependent on currents in the surrounding water, whether those currents be produced by the action of the Annelid

or by other causes. They are not rhythmical; each individual appears to be animated by a distinct volition.

Applying a higher magnifying power than we have yet use to these animals, we find that the head-lobe encloses a central cavity; that the arms are also hollow, with thick walls, marked with transverse lines, indicating flattened cells, and muricated on the exterior; and that the body contains an undefined, sub-opaque nucleus, doubtless a stomachal cavity.

I cut out, with fine scissors, a segment of the tube, including two of the parasites, with the portion of the network of threads that carried them. They have become immediately paralysed by the division of the threads, but those that remain on the tube are unaffected by the violence. Subjecting one of the animals so cut out to the action of the compressorium, with a power of 560 diameters, the arms are seen to be formed of globose cells, made slightly polyhedral by mutual pressure, set in single series.

The interior of these organs is divided by partitions, placed at intervals of about the diameter. Some at least of the cells contain a bright excentric nucleus.

When the tissues were quite crushed down by the pressure of the compressorium, a quivering motion was visible among the disjointed granules, but it was very slight. No trace of cilia, nor any appearance of ciliary motion was perceptible during life.

When I first discovered the strange beings, I was much astonished by what I saw; nor could I imagine to what class of animals they were to be referred. Neither did I know whether their presence on the tube of the worm was a mere accident, or whether it indicated a pre-dominant instinct. On both these points, however, light has been thrown.

This larger Sabella tube was not the only one infested with the parasites. I observed them on at least two

smaller specimens of the same species, in the same situation, and with the same movements. The extremity of one of these smaller tubes I cut wholly off, and placed in the live-box of the microscope. Two of the parasites only were on it, which were active at first, but in about an hour—probably from the exhaustion of the oxygen in the small quantity of water inclosed—they decomposed, or rather disintegrated, the outline dissolving, and the external cells becoming loose and ragged, the whole animal losing its definite form.

One of these specimens, however, while yet alive and active afforded me an observation of value. I had already associated the form with the Hydroid Polypes, and was inclined to place it in the family Corynidae, considering the arms to be tentacles, and the head lobe to be homologous with them in character, but abnormal in form. It appeared to be a three-tentacled Coryne, with the tentacles simple instead of capitate. But while I was observing it, I saw it suddenly open the head-lobe, and unfold it into the form of a broad shovel-shaped expanded disk, not however flat, but with two halves inclining towards each other, like two leaves of a half-opened book. This reminded me of the great sucking-disk of *Stauridia producta*, and confirmed my suggestion of the natural affinities of the form.

Formalin in the Zoological and Histological Laboratory.

D. S. KELLICOTT,

COLUMBUS, O.

Member of the American Microscopical Society.

How often in the memory of most of us has the suffering world been startled by the announcement, often by the highest authority, of some wonderful medicine, specific or elixir. These, one after another, have been put to the test and have taken their places among the useful

remedies, but on a plane below, often far below, the first claim and initial hope. Is it to be thus with Formaldehyde as an antiseptic, as remedial agent, as preservative, as a histological fixative? It can only find its true plane among its kind by conscientious trials made and reported by investigators. During the last year it has been used in the laboratory of the Ohio State University quite extensively as a preservative and for histological purposes. I have brought together in this paper the results and the reflections to which they obviously lead. Papers have appeared in the last year or two giving results from laboratories along similar lines. I may say at the outset that my experience leads to conclusions essentially in accord with results heretofore published.

In the statement of trials I shall by "per cent" mean per cent by volume of the forty per cent solution of formaldehyde in water, procured of Sharing & Glatz of New York, and distilled water. I have found this standard solution known as formalin fairly constant, and so a reliable solution may be thus quickly made of pretty constant strength.

I. As a preservative I have tried it on a variety of objects, using varying strengths with results to be noted.

Experiment 1. Small sunfish perfectly fresh was put into two per cent formalin Feb. 2; March 1 it was well hardened without shrinkage; colors fairly preserved compared with the best alcoholic specimens; eyes better; fins extended. The fluid was filtered, the bottle sealed and given a place on the shelf. July 1, no perceptible change observed.

Experiment 2. Two common eels from the market were immersed in four per cent March 11. July 1, examination showed that they were in perfect condition as to color, absence of shrinkage and firmness. The fluid had colored slightly and there was a sediment. Filtering ren-

dered the specimens fairly representative museum preparations, fit for systematic or anatomical purposes.

Similar trials were made with a variety of fish naked and scaled, large and small, with uniformly good results. A stronger solution, up to ten per cent, was found superior for larger specimens; the colors are better preserved in solutions as strong or stronger than three to four per cent.

Experiment 3. *Amblystoma jeffersonianum* killed with chloroform Mar. 1, put up immediately into two per cent formalin; at the end of four days it was found to be quite hard, color very slightly changed, costal grooves plainer than in the living animal. The fluid was filtered and was still clear July 1, while the preparation left nothing to be desired.

Experiment 4. *Amblystoma tigrinum* treated similarly but put into four per cent gave excellent results. So far as appears, for museum, systematic or anatomical purposes it was no better than specimen in experiment 3.

Experiment 5. *Amblystoma tigrinum* was killed April 5, with chloroform and the mucus washed off with water as in experiments 3 and 4; it was then placed in equal parts of ninety-five per cent alcohol and two per cent formalin. July 1 the specimen was far superior in appearance and preservation to any that I have ever been able to prepare by means of alcohol alone. I cannot say it is superior to that of experiment 4.

Other Amphibia and several Reptilia have been preserved in a water solution of formalin and in alcohol-water formalin with excellent results so far as the time that has elapsed permits of a demonstration. It seems to be the best method for Ophidia.

Experiment 6. A tongue of a lion was thoroughly washed in water to remove blood, mucus and dirt and treated February 5 to a five per cent solution of formalin.

July 1 it was found well hardened, in clear fluid with but slight indications of shrinkage.

A camel's tongue, larynxes of spider monkey, camel and kangaroo were cleaned, washed and preserved in from two to four per cent during February and March; they are at present fine preparations.

Experiment 7. Several trial were made to harden and preserve brains, with different per cents of formalin, with alcohol and formalin, and with formalin and bichromate.

I will speak particularly of a few :

1. A brain of a spider monkey removed twenty-four after death was placed in four per cent formalin. In a very few days it was firm, remained white and did not noticeably shrink. July 1, it was all that could be desired in a museum specimen.

2. The brain of a kangaroo was hardened in forty or fifty per cent alcohol and two per cent formalin, equal parts; the results were no better; the specimen was as good and prepared in less time than by alcohol alone; and of course much more cheaply prepared.

3. Brains of dogs and cats were prepared for anatomical purposes by adding to the usual bichromate solutions one or two per cent formalin. A smaller quantity of fluid was necessary, not so many changes and a great gain in time; the material was excellent, not brittle and with fine contrasts.

Before stating my general conclusions as regards this agent in preserving museum and anatomical preparations, I would like to add a note as to its usefulness in another direction, viz., in preserving animals for dissection. If the subject is a small dog, its blood vessels are washed out with salt solution and 250 cc. more or less of five per cent formalin injected. Thus prepared and kept in a cool place, when not under examination, it may be used by the dissector day after day and for several weeks without unpleasantness. The brains of animals thus treated

may be removed for study much longer after death than in any other way known to me, at the same cost of material and time.

The advantages of formalin in the lines discussed above may be summarized briefly thus: It is cheaper than any other method that gives good results; it gives results in much less time; the colors are better preserved and there is less change of form by shrinkage or by swelling; its penetrating power is excellent so that insects, crustacea, etc., preserved in it are fit for work on the internal organs; for mollusks and vermes it is also excellent.

Its disadvantages should likewise be stated. It is extremely volatile and the jars have to be sealed with care. I have not had it in use long enough to decide how great an obstacle this will prove in the museum. Again, the water solution will freeze and not all museums are at all times above 0°C. In such cases, if not in all, hardening in formalin and transferring to the lowest per cent alcohol that will preserve would seem to be the better and cheaper way. I have not yet had the opportunity to demonstrate to what extent preparations thus preserved may be treated to additional alcohol to replace that lost by evaporation, without a precipitate.

II. Experiments with formalin for histological purposes were undertaken in February last. The visceral organs of *Cryptobranchus* were placed while perfectly fresh in a suitable solution of borax carmine with five per cent formalin; the third day the pieces were washed, the stain fixed and dehydration in sixty per cent alcohol commenced; they were passed rapidly through alcohols of increasing strength, and the end of seven to ten days were infiltrated with paraffin and ready to cut. The liver, intestines and kidney were sectioned, leaving nothing to be desired in stain or character of the cells.

Parts were at the same time hardened in five per cent

without bulk stain, also in dilute alcohol and formalin. We concluded that the rapidity and less shrinkage were alone sufficient to recommend the use of the new agent.

Mr. J. H. McGregor, who was conducting an investigation of the central nervous system of *Cryptobranchus* in the same laboratory, used the agent in combination with alcohol and other agents to his entire satisfaction. He will doubtless give his results when his paper is printed. Another student used it successfully in preparing the eyes.

I may say, in short, that the result of the few months of trial warrant a high estimate of it for fixing animal tissues.

Care of the Eyes.—In the earlier use of the microscope the care of the eyes cannot be too persistently urged. The wrecks of those wonderful organs along the shores of microscopy are too numerous to be ignored, or their lessons unheeded. Many more which have begun without rules have reluctantly abandoned the fascinating use of the instrument before utter instruction, but with impaired vision who, had they been governed from the first by the following hints, might have made comparatively weak eyes strong, and attained eminence in this pivotal, key-note, science and art.

- (1.) Begin exclusively with your lowest power objective.
- (2.) Until self-mastered use but one object at a sitting.
- (3.) Lengthen the time only five minutes at each sitting.
- (4.) Never begin work heated, angry, or greatly excited.
- (5.) Stop instantly at the first scratchy-feeling in the eyes.
- (6.) When two hours is not weary, you are safely initiated.

Now use the next higher power objective under the same rules, half of the sitting time at each sitting, and thus on, on, on, as necessity, or inclination beguiles or commands. "Excelsior, excelsior."

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CHARLES W. SMILEY, A. M., EDITOR.

EDITORIAL.

Carl Vogt, aided by Emile Yung, of the University of Geneva, has issued in two volumes of 900 and 1,000 pages with 798 engravings a work entitled, *Traite d'Anatomie Comparee Pratique*. He has long been associated with the laboratory of Comparative Anatomy and Microscopy at Geneva. The volumes can be bought from Schleicher Freres, Paris. Price, 64 francs, for the two volumes.

QUESTIONS ANSWERED.

NOTE.—Dr. S. G. Hawks, of Albany, N. Y., kindly consents to receive all sorts of questions relating to microscopy, whether asked by professionals or amateurs. Persons of all grades of experience, from the beginner upward, are welcome to the benefits of this department. The questions are numbered for future reference.

240. *Where can I obtain Lecithin that I may try it on some of my patients by hypo injection?*

Listed by Merck & Co., New York, N. Y., 15 grain vial \$2.50. It is a phosphoric compound from brain or egg yolk.

PRACTICAL SUGGESTIONS.

By L. A. WILLSON,
CLEVELAND, OHIO.

Volvox globator.—This interesting object can now be found in many fresh-water ponds. When collected in a glass jar or bottle, it may be easily seen with the unassisted eye. They may be observed as little balls floating around in the water. They should be examined in a slide with a hollow cell; a very shallow cell is preferable, for in them the specimen may be examined with a one quarter or on fifth objective.

Glycerine Jelly for Mounting.—Many objects, especially objects containing moisture, are unsuitable for mounting in balsam. For such objects, as for instance mosses, liver mosses, stained leaf sections, spores and many others, are best mounted in glycerine jelly. The jelly can more conveniently be procured from a dealer.

Kaiser's Glycerine Jelly is composed as follows:—

Finest French gelatine, 1 part by weight; soak two hours in six parts by weight of distilled water. To this add seven parts of chemically pure glycerine and to each one hundred grams add one gram of carbolic acid; then warm and stir constantly for ten or fifteen minutes until all flakes disappear. Filter while still warm through funnel filled with glass wool. Before using the wool wash it and place in the funnel while still moist. The jelly should be warmed each time it is used. When using, warm the slide, place a drop on it with a glass rod and warm the cover glass before using. After cooling, ring the edge of the cover with varnish or cement.

Fixing the Cilia of Infusoria.—Use one part of tannic acid to four parts of glycerine. On placing a drop of water containing the cilicita on the slide drop a minute quantity of this fluid into the water and allow the two fluids to flow together. If the right quantity of the fluids is used the cilia will gradually become more and more distinct and will stand out plainly until the animal seems to be entirely surrounded by them.

SCIENCE-GOSSIP.

A New Adulteration of Senega Root.—In the early part of 1894, Ad. Andree of Hanover drew attention to an interesting adulteration found in senega root imported from New York, the drug containing 25 per cent of foreign root which he referred to as *Richardsonia scabra*. The structure of the drug, however, showed this identification to be incorrect; the starch in the two roots differed in character, and in the *Richardsonia* the oxalate of calcium assumed the form of raphides, while in the adulteration referred to it was present as cluster crystals. C. Hartwich, *Archiv. der Pharm.*, believes the root to be that of *Triosteum perfoliatum*, L., *Caprifoliaceæ*, which has recently appeared as *ipecacuanha*. Externally the roots showed the greatest similarity, and the histological and chemical examination proved their identity.

Triosteum perfoliatum is indigenous to the eastern and southeastern United States, and therefore might easily be collected with senega, although the two plants are very different in appearance. *Triosteum* is a shrub with a thick knotty rhizome, from which arise several stems reaching nearly 3 feet in height; it is known in America as tinker's weed, bastard ipecac, etc., and is used somewhat extensively as an antipyretic, purgative and emetic.

The drug consists of a yellowish brown or dark brown bent, knotty rhizome, to the sides and under surface of which are attached numerous roots, generally not over $\frac{1}{2}$ ccm. thick, and often much thinner; these are lighter in color than the root stock, show here and there transverse fissures and resemble many varieties of false *ipecacuanha*, especially *Richardsonia*. In general appearance it is so like senega that its presence seems to have been overlooked; it differs, however, in the absence of a keel.

The structure of the root is very characteristic. A transverse section exhibits a radiate wood without pith and a cortex, in which a narrow pale outer portion can be distinguished from a darker inner part. Next to the cork

is a layer of large compressed cells (primary bark) containing here and there a cluster crystal of calcium oxalate. Between this and the secondary bark is a layer of four or five rows of cork cells, the outer of which have undergone an unusual elongation in consequence of which the primary bark has become compressed, and is eventually thrown off. The cortex contains numerous cluster crystals of calcium oxalate and starch in compound or simple grains reaching 0.015 mm. in length. The wood is remarkable for the fact that the medullary rays are lignified, while in the xylem rays only the middle lamella yields the lignin reaction.

The *Triosteum* root contains an alkaloid which Andree considered identical with emetine. Hartwich, however, was unable to obtain the characteristic reaction with hydrochloric acid and chlorinated lime and concludes, therefore, that the alkaloid is not emetine.—American Druggist.

Treatment of Diphtheria in Berlin.—During 1894 and 1895, 245 diphtheria patients at Am Urban Hospital in Berlin were treated with antitoxin with a mortality of 28 per cent while among the 146 who were treated otherwise the mortality was 42 per cent.; 53.2 of the serum cases were serious, 23.7 severe, and the rest slight. The effectiveness of the serum was proportionate to the earliness of its application and the strength of the first doses. The hospital reports conclude that antitoxin is not an infallible but a valuable remedy.

Leprosy is said to be spreading in the Russian Baltic provinces with alarming virulence. Several hundred persons are said to be afflicted with the disease, and the Livonian Diet has just taken measures for isolating them at the cost of the State.

Typhoid Fever caused thirty-six per cent of the deaths among the British troops in India during the year 1894.

RECENT PUBLICATIONS.

Traite de Physiologie humaine contenant l'Histologie et l'Anatomie microscopique et les principales applications a la Medecine pratique. par L. Landois. Un volume grand in-8 orne de 356 figures dans le texte. Cartonne a l'anglaise. Schleicher Freres, 15 Rue des Saints Peres, Paris, 32 fr.

Professor Landois is Director of the Physiological Institute at Greifswald University. This translation into French is from the Seventh German Edition and is made by G. Mopuin Tandon, a professor in the Toulouse faculty of Sciences.

La Structure du Protoplasma et les Theories sur l'Heredité et les grands Problemes de la Biologie generale. Schleicher Freres, Paris.

This book, the remarkable work of Dr. Yves Delage, is addressed to philosophers and to students of scientific matters as well as to naturalists and medical men. The author has divided his work into four principal parts. The first part, entitled The Facts, is subdivided into three books: The Cell, the Individual, the Race. The second part treats of Particular Theories. In the third part are exhibited the General Theories of all the French and foreign authors who have treated these questions: Buffon, Bechamp, Herbert Spencer, Haecke, Dolbear, Erlsberg, Hackel, Hux, Cope, Orr, Mantia, Hanstein, Berthold, Chevreul, Geddes, Tohmponson, Gautier, Danilevsky, H. Fol, Maggi, Altmann, Wiesner, Weismann, Charles Darwin, Maupertuis, Erasmus Darwin, Galton, Jager, Brooks, Gaule, Platt-Ball, Hallez, Nageli, Kolliker, H. de Vries, O. Hertwig, Descartes, Roux. Then in the fourth part, after a comprehensive glance over the general current of ideas, we have, under the title of Theories of Existing Causes, an exposition of the author's ideas on these important subjects, which are now the questions of the hour.

THE MICROSCOPE.

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THE MICROSCOPE

JUNE, 1896.

NUMBER 42

NEW SERIES

Objects Seen Under The Microscope

BY CHRYSANTHEMUM.

XXXII.—THE SCALE OF INSECTS.

It is well known to every one that the dust which remains on the fingers after touching a butterfly's wing is a mass of beautiful feathers or scales, varying in shape and color with the different species. Some of these are so delicately ornamented that no unassisted eye can see them and some of them are used as test objects for the microscope. It is interesting to view parts of the wings as opaque objects, thus observing the arrangement of the scales which is much like that of the tile on a roof. (Figs. m, n, and o.)

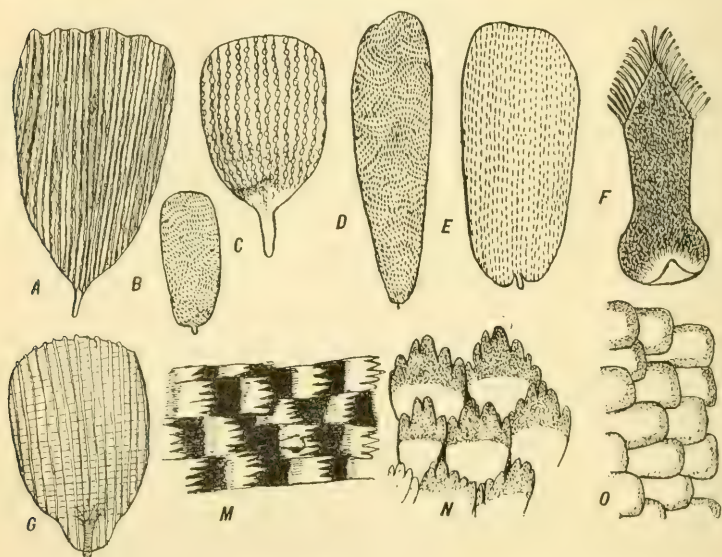
The common cabbage butterfly has several different shapes in the scales of its wings, some are very long and slender, some battledore shaped, while others are heart shaped. In looking at the wing, observe the membrane where the scales have rubbed off and you will see little cups or tubes into which the scales fit, and around each are radiating folds of the upper membrane, giving them a star-like appearance.

The *Morpho-menelaus* (fig. A), a blue butterfly, has striated scales, and with a high power each line is seen to be slightly beaded. Each scale consists of three distinct laminae, two external and colored, and the inner one a highly polished colorless membrane, which reflects the light and increases the brilliancy.

Polyommatus argus (fig. C), another blue butterfly

and a frequenter of our cornfields, has peculiar scales shaped like a battledore with a long handle, and the longitudinal lines are swollen at intervals into rounded elevations, which give a dotted appearance, except towards the base, where a crescent-shaped cloud of minute pigment-cells crosses the scale, and forms a distinguishing mark of the species.

Scales can be mounted dry or in balsam and can be used as opaque or transparent objects. The silkworm,



moth (*Bombyx mori*) has a variety of scales, some toothed, some broad and some narrow, and it is said there are 400,000 of these scales on the wings of one moth. The scales from the under side of the little clothes-moth are very finely striated and make good test objects. Also those from the *Podura* (figs. B, D, and E), found in the spring about sawdust, under stones, and in damp places. It has six legs but no wings, and its body is covered with beautiful scales.

The *Lepisma saccharina* is the little silvery gray in-

sect which runs swiftly along and which haunts our sugar stores. Its body is closely covered with delicately marked scales. These are the *Podura* scales which were so much used as test objects (fig. D). Under a medium power they resemble watered silk, light and dark lines wove across the scale in irregular bands. But with a higher power the dark lines are seen to be rows of short lines, thick at one end, very fine at the other. Yet those apparent lines are not lines at all. Take a higher power still and with careful mangement of the light, we shall see that the apparent lines are really spaces between the wedge-like particles which make up the upper-layer of the scale.

The Diamond Beetle has groups of brilliant scales fashioned precisely like those of the butterfly's wings but owing to their iridescence, to the peculiar thinness of the upper layer and the reflecting power of the second layer, the color changes like that of a soap bubble. The dark cell in which the scales are set adding to their brilliancy.

At the sea-shore may be found the *Machilis* (fig. G), a wingless but active little insect commonly known as the Bristle Tail. Touch your finger to one of these insects and then to a glass slide and examine under the microscope. You will see myriads of the scales, some heart-shaped, some shovel-shaped, some round, oval elliptical, half round, half elliptical, long and narrow, sometimes irregular and unequal and of various other outlines, each scale has a minute footstalk which is not connected with it at either extremity, but at a point of one surface a little way from the smaller end, whence it projects at an oblique angle, so that when the stalk is inserted in its cell the scale will lay horizontally, covering the insertion (fig. G). This is a peculiarity not found in many other scales. The whole body of the scale is traversed by five close-set parallel lines running longitudin-

ally from end to end. Scales are sometimes triangular in shape, as in the Emperor Moth, deeply notched at the end, having from two to five projecting points longer even than the integral portion of the scale.

Pieris Glaucippe, a butterfly from China, has the scales tipped with a curious sort of fringe (fig. F). The scales are straight, parallel-sided, rather narrow, with a basal end rounded and the terminal extremity tapered abruptly to a point. It is on each slope of this point that the fringe is arranged. The surface is smooth, and excepting around the foot stalk, is filled with pigment grains, while the footstalk is turned in under the scale. Fig. M represents the scales from the Underwing Moth (fig. N), the scales of the Brimstone Butterfly and (fig. O), those of the Admiral Butterfly.

Use Of Ordinary Binocular For Dissecting.

BY JOHN TATHAM, M. A., M. D.

For many years past I have been trying to hit upon some simple method of using the stereoscopic binocular instrument for purposes of dissection, and of mounting slides for the microscope, because I have repeatedly found that the use of the best simple microscope for long periods does seriously impair the sensitiveness of the retina for observation with the compound instrument.

I have brought with me the stand which I now employ. It is a very small binocular, on the Rousselet model, and is fitted with a rack-work substage. Into this substage is fitted a brass ring carrying a plate, or supplementary stage, of the form now shown. This supplementary stage is made of exactly the same width as the principal stage of the microscope, and the sliding object carrier of the latter is made to slide easily over the supplementary stage. The object of this arrangement will be shown

hereafter. When used for dissecting or mounting, the instrument is placed in the vertical position, on a table only so high as is necessary to allow of work in a sitting posture. A low power, say an inch or three inch, is screwed into the nose-piece. The objective is then racked down through the aperture of the principal stage, and is focussed on the object lying on the supplementary stage already described, a bullseye condenser, of the aplanatic form suggested by Mr. Nelson, being used in the case of opaque objects.

Two wedges, or inclined planes of wood, are arranged as supports for the wrists, one on either side the microscope, or in default of these a couple of thick books can be similarly used.

It only remains to be said that with the above simple arrangement, which certainly is not an expensive one, any small binocular can readily be converted into a dissecting microscope, or a mounting instrument, or it can be used with a four-inch or lower power, for the examination of animal or vegetable forms in sea water; and thus the mechanical adjustments of one's larger and more delicate instrument are preserved from harm.

The advantages that may be claimed for this "adaptation," which by the way may possibly be as well known to some others as to myself, are as follows:—

1. The use of the simple form of microscope, with all the discomforts incidental thereto, is avoided, and the binocular is available in place of the single tube.

2. The same "rack" microscope may be used, either for ordinary high power work or for dissecting purposes, by simply transferring the object and the sliding clip from the ordinary to the supplementary stage.

3. An instrument of relatively small size, and consequently with short rack work, may be used with long focus lenses, which otherwise can only be used in connection with full-sized stands.

4. An instrument such as the one I show this evening can be used with very great comfort in the sitting posture, with the arms and wrists resting on the inclining planes above described. This would be impracticable with a full-sized stand racked up so as to focus a three or four-inch power on an object lying on the ordinary stage.—Quekett Microscopical Club Journal.

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CHARLES W. SMILEY, A. M., EDITOR.

EDITORIAL.

The Mississippi Valley Medical Association.—A meeting of the Executive Committee of the Mississippi Valley Medical Association was held at Atlanta, on May 6th, and the following gentlemen were appointed to deliver addresses:

Dr. H. N. Moyer, Chicago, Address on Medicine.

Dr. Horace H. Grant, Louisville, Address on Surgery.

The indications are that the meeting to be held at St. Paul, on Oct. 20, 21, 22 and 23, will be the largest and most successful in the history of the Association. As all the railroads will offer reduced rates for the round trip, an opportunity will be given to visit St. Paul and Minnesota during the most delightful season of the year.

PRACTICAL SUGGESTIONS.

BY L. A. WILLSON,

CLEVELAND, OHIO.

Crystals from Blood.—It is interesting and frequently of pathological importance to examine crystals in blood.

Crystals in blood are most readily formed, if a drop of blood be enclosed beneath a thin cover glass, allowed nearly to dry, and a small quantity of water be added.

To obtain haemin crystals, place blood on slide and add a drop of water containing a trace of salt; apply a thin glass; allow a little glacial acetic acid to flow in and mix with the blood. Then apply heat until the mixture almost boils. Examine the resulting crystals with a one fourth or one fifth objective. The haemoglobin crystals differ in shape in the various mammals. They are always of microscopic size and of a bright red color.

In man and most mammals they are of the shape of prismatic needles, or rhombic plates.

Melicerta Ringens.—This beautiful animal may be found both in fresh and stagnant water. A fine picture of this specimen may be seen in Dallinger's Carpenter, 7th ed., Plate XV, fig. 3. They are attached to roots and stems in the water. Their presence may be detected by the unassisted eye. They are generally in colonies. They are attached by a foot which is prolonged into a pedicel. They build for themselves a sheath, or carapace of pellets which they secrete. This sheath is their permanent home. When broken they repair the damage. When alarmed they retreat into the sheath. When all is quiet, they protrude from the sheath, unfold their arms and vigorously revolve their cilia. To the eye the sheath appears very dark brown, or nearly black. Under the microscope they are of an orange brown color. To examine, place the twig or rootlet containing them in a shallow cell and cover. They may be nicely seen with a one inch objective, but for finer details a higher power may be used. In collecting—gather the roots and stems from the water and place in a

flat bottle. "As a general rule old dark looking, but still sound and green branches will be the best." By placing them in a flat bottle, they may be examined with a pocket lens.

BEALE'S CARMINE.

Carmine	10 grains
Strong liquor of ammonia.....	$\frac{1}{2}$ drachma
Glycerine.....	2 oz
Distilled water	2 oz
Alcohol	$\frac{1}{2}$ oz

Dissolve carmine in the ammonia in a test tube by aid of heat; boil it and cool and add other ingredients. Filter.

SCIENCE-GOSSIP.

Chemistry in the Diagnosis of Bacteria.—Dr. Fritz Kiessling calls attention to the importance of this subject. It is a well-known fact that the differentiation of the colon bacillus from the typhoid fever germ offered serious difficulties till Dr. Theobald Smith used the fermentation tube test in differential diagnosis. Dr. Kiessling calls attention to such well-known physiological properties as peptonising of gelatin and blood serum. Such products of vital activity as the coloring of the medium as is *bacillus pyocyaneus*. Attention is called to acid and alkaline curdling of milk. Species that have the power of reducing nitrates to nitrites, the production of indol. Phenol is another common product. The production of acids and alkaline substances, scatol, kreatine. Acid or alkaline condition of the medium is important. Kiessling mentions many other substances that must be taken into account for special organisms.—*Pharmaceutische Rundschau*.

Oysters and Feeble Digestion.—One of the interesting observations made recently in the bacteriological department of the laboratory was in relation to the number of microbes in oyster juice. It was found that 1 c.c. of oyster juice produced in an agar culture, 1,500,000 colonies. The observation entirely justifies the position of the late

Dujardin-Beaumetz, one of the most eminent of French physicians, that oysters should never be eaten by persons with feeble digestive powers or those suffering from dilatation of the stomach. There is no article of food which decomposes more readily in the stomach than does the oyster, and none more likely to communicate infection through the setting up of decomposition and fermentation in other foods. The oyster is always a carrier of microbes, and recent observations show that it often communicates typhoid fever and other pathological germs.—*Modern Medicine.*

Transmission of Tubercle.—Jaeckh (*Virch. Archiv.*) investigated the question whether the sexual glands or their secretions contain virulent tubercle bacilli. He used the testicles and the contents of the seminal vesicles, as well as the ovaries of tuberculous patients who had died either of chronic pulmonary tuberculosis or of general miliary tuberculosis. Portions of the sexual organs or of the semen were introduced into the abdomen of guinea pigs and rabbits. Of five cases in which portions of testicle or of semen were injected, positive results were obtained thrice with the semen and once with the testicular substance. All the rabbits remained healthy. Of three injections with ovary one gave a positive result. Examination of the young tuberculous female guinea-pigs gave only one positive result. It appears, therefore, that the semen may contain virulent tubercle bacilli, and that transmission of tubercle from mother to child is not the general rule.

Cholera Vibrio in Hen's Eggs.—According to an influential Russian daily paper, a Russian physician, Dr. Golowkow, has announced that he has conclusively demonstrated that the cholera vibrio can penetrate the shells of hen's eggs and enter the interior of the eggs.

Preservation of Blood for Examination.—H. Kral, chemist in Olmutz, writes to the *Pharmaceutische Centralhalle* that having on several occasions preserved the blood of lower animals for some time unaltered, under admixture of sul-

phuric ether, he has recently been able to preserve human blood in the same manner. For several weeks, he states, he has kept, in ordinary test tubes, lightly corked, human blood and on examination he finds it absolutely unaltered.

Examination of Spots on Wood for Spermatozoa.—Some time since we published a process accredited to Schumaker-Kopp, for facilitating this sometimes very difficult examination. Since then, having to make several examinations, we have found the following modification to answer better than the original. With a sharp knife remove the surface of the spot, either by scratching or by cutting a delicate sliver. Let the debris fall into a thin nearly flat watch crystal, and cover them with dilute water of ammonia for several hours, occasionally moving the material about with a dissecting needle. After standing for from four to six hours, carefully decant or draw off the liquid with the supernatant debris, leaving the precipitate on the watch-glass. To the latter add a little distilled water and let stand until the precipitate has again subsided. Pour off all of the water that can be removed without danger of disturbing the precipitate, and to the latter add a drop or two of picric acid solution or aniline violet. Stir up and remove the material with a pipette to slips, putting a drop-let on each slip. Examine a slip by dropping a cover glass on the liquid. Sometimes the spermatozoa can be detected, but if not, let the liquid dry on the slip spontaneously, and then examine, either with glycerin or with dammar. Very rarely an entire spermatozoan may be found, but usually (where they are present at all) they will be found in a mutilated or broken condition.—*National Druggist*.

Bacteria in Oysters.—An outbreak of typhoid fever amongst those who attended the Stirling County Ball in October, 1895, gave rise to the suspicion that the oysters supplied on that occasion were the carriers of infection, but Dr. Chalmers, one of the Glasgow medical officers of health, investigated the matter and concluded that the cause of the enteric fever infection was not conveyed in the oysters. A bacteriological examination of oysters from

the same oyster-bed was undertaken later by Mr. D. M'Crorie, lecturer on bacteriology at St. Mungo's College, and he was able to isolate from them six distinct germs, of which four, including *Bacillus fluorescens liquefaciens* and a vibrio, liquefied gelatin. The fifth was a typhoid-like bacillus and the sixth a torula. The typhoid-like bacillus was found to differ considerably from the *Bacillus typhosus* of Eberth, Drs. Kanthack and V. D. Harris agreeing with Mr. M'Crorie on this point, and it was therefore assumed to be one of the pseudo-typhoids. It was found to differ from Eberth's bacillus in being virtually non-pathogenic to animals, and having a different optimum temperature, besides which it did not seem to possess so many flagella. The vibrio isolated was larger than Koch's cholera vibrio, but closely resembled the Finkler-Prior bacillus, and there was no reason to suspect that it played any part in the causation of the fever.—*Pharmaceutical Journal*.

Counting Blood-Corpuscles.—Dr. Judson Daland, of Philadelphia, has invented an instrument for counting blood-corpuscles, according to the *Physician and Surgeon*. It works on the centrifugal-force principle, and accomplishes the measurement by means of comparative bulks. A quantity of blood is placed in a finely graduated tube and the latter revolved at a speed of about 1,000 revolutions a minute. The corpuscles divide by force of gravity, and form on the sides of the tube in easily traceable divisions of red corpuscles, white corpuscles and serum. The new method permits of larger, and, consequently, more representative quantitatives being used in experimenting, besides doing away with actual microscopic counting.—*Medical Times*.

A Process of Sealing Glass Vacuum Tubes.—In making vacuum tubes it has been the almost universal custom to attach a branch for exhaustion. But Mr. T. Bolas, who is well known to be an expert in this kind of manipulation, finds it much more convenient to avoid the extra branch and exhaust where a platinum wire is sealed in. For this purpose the end last closed is drawn out until the bore is

a little larger than the diameter of the platinum wire, which is now placed in position. The exhaustion being complete, the narrow tube around the wire is heated, and the glass becomes compressed around the wire. When cold the superfluous part of the tube is cut off, and it is then easy to free any required length of the wire from the glass by crushing with nippers or on an anvil, after which the seal is rounded off in the blow-pipe flame. In this way minute vacuum tubes like beads, the interior of which is but one-eighth of an inch long and one-sixteenth of an inch in diameter, can be readily made, and, apart from decorative uses of such tubes in chains or festoons, surgical uses for minute high-vacuum tubes may possibly be found in connection with Rontgen's method of observing, and recording on sensitive surfaces.—*The Optician*.

Purification of Drinking-Water by Means of Filtration.

—The report of the Massachusetts State Board of Health for the year 1894 contains some very interesting and important facts upon all these points.

For the past seven years the board has maintained an experimental station at Lawrence for the sole and express purpose of testing the efficacy of filtration of water to purify it and render it fit for household purposes. The water tested was that of the Merrimac River, which is lined from source to mouth with manufacturing towns, and which may be taken as a fair sample of river water contaminated with a considerable amount of organic matter.

The filters were of all sizes and thicknesses, from those a few feet square and ten inches in depth to the large filter covering two and one-half acres, through which the water supplied to the city of Lawrence has been filtered since 1893.

Chemical and bacteriological examinations were made weekly and sometimes daily of the water of ingress and egress. Sand of different sizes was used, and the filters were run both intermittently and continuously.

The result of this careful and painstaking investigation extending over a number of years and every source of

error being eliminated, are both astonishing and gratifying.

From a bacteriological standpoint they prove that a properly constructed and properly managed filter will remove from 98 to 99.84 percent of the ordinary bacteria in water, and that if such bacteria as the bacillus prodigiosus, which is very similar to the typhoid bacillus, be added to the water in varying proportions, the filter will remove from 99 to 99.993 per cent. The organic matter in solution is greatly diminished and the water is chemically purified.

Moreover, the efficiency of the filter instead of diminishing increases with age and use, owing to the formation of a gelatinous coating about each grain of sand, which serves to entangle the bacteria in their progress.

The rate of filtration may reach five million gallons daily per acre of filter without impairing the efficiency. If the surface-clogging is properly removed there will be no appreciable difference in the quality of the filtered water during or after the process of removal.

Finally, the cost of construction and maintenance of such filters is not so great as was supposed, and is not to be compared with the benefits derived from their use. The one which has been in successful use in the city of Lawrence proves that the plan is practicable in supplying cities with potable water. It seems to us that the knowledge derived from these experiments should be spread abroad and the attention of the municipal authorities called to them.—Medical Record.

Note on the Permanent Staining of Ringworm Fungus.
—H. G. Adamson (*Brit. Jour. Dermat.*), for the staining of ringworm fungus, combines the caustic potash solution with the ordinary staining method. Dr. Adamson claims that the keratin nature of the horny tissues is lost by the use of the caustic potash, and that decolorization takes place as in non-horny epithelial tissues (*Am. Med.-Surg. Bull.*) The details are as follows: 1. 5-per cent-10-per cent solution of caustic potash on the slide for ten to thirty minutes. 2. Wash 15 per cent alcohol in water. 3. Dry

the slide, and in the case of scales, fix by passing through the flame. 4. Stain in gentian-anilin-violet (made in the usual way by the addition of a few drops of saturated alcoholic solution of gentian-violet to anilin-water), fifteen to sixty minutes. 5. In Gram's iodine solution one to five minutes. 6. Decolorize in anilin-oil two or three hours or longer. 7. Remove anilin-oil by blotting paper and mount in Canada balsam.—*St. Louis Med. and Surgical Journal*.

Perservation of Mucilages and Pastes.—Considerable has been written from time to time about preservation for mucilages and pastes. Oil of cloves, creosote, carbolic acid, and various other things have been recommended, but none of them in my experience has served the purpose, and the paste-pot in the great majority of instances, is far from sweet-smelling.

For the use of the pharmacist a nicely made flour paste, in my opinion, is the most desirable adhesive that can be used; but unfortunately it is very prone to sour. Starch paste, even with the addition of glycerin, soon sours and becomes useless. In places where considerable quantities of paste are used this is not a matter of so much consequence, for it can be made in such amounts that it will be used up before it spoils, but to the retail pharmacist wishing to use it for his labels or to the photographer using it for his mounting, it is different, and so many have adopted the expedient of buying the patent pastes of the market.

Stepping into a leading drug store not long ago, I noticed a bottle of library paste sitting on his prescription case. I asked the proprietor whether he liked it better than flour or starch paste. No, he said, but he knew of no way of keeping these from souring, and so had been using the patent article. With a view of overcoming this difficulty I began a line of experiments during the month of November last, but failed to find anything that proved satisfactory for sixty or ninety days. When about to quit in disgust, the thought struck me that perhaps formaldehyde was the agent I was looking for. In order to give this agent as thorough a test as possible I made the following experiments and numbered them in the order made and

set them on the shelf where the temperature was usually very warm :

Experiment No. 1. (Date, January 20, 1896).—Mix 8 ounces of flour and 4 pints of cold water, and stir till free from lump; add one-half ounce of pulverized alum, stir thoroughly and place in the water bath and boil till of proper thickness; then transfer to an earthenware jar, and when cool stir in one-half ounce of a 40 per cent solution of formaldehyde. This has stood from the time made till May 10 in the jar, covered but not sealed, and at the present writing I am using this paste as sweet and in as good condition as when first made.

Experiment No. 2.—Take of gelatin, 1 ounce; flour, 4 ounces; water, 3 pints; formaldehyde $\frac{3}{8}$ ounce. Cover the gelatin with one pint of water and allow it to soften, then heat to dissolve, mix this with the flour and 2 pints of water previously made into paste, and boil them. When cool mix with formaldehyde. This paste at the end of sixty days showed no signs of spoiling, being fresh and sweet, although it had been exposed to a summer temperature all the time. Still it was necessary to keep it covered when not in use. A portion that was left uncovered for a week became watery.

Experiment No. 3.—Mix starch, 2 ounces, and water 16 ounces, and make a paste by heating. When cool add $\frac{1}{4}$ ounce of formaldehyde. This was made on the same day as No. 2 and subject to the same conditions. It is in perfect condition at the present writing.

Experiment No. 4.—Mucilage of acacia, U. S. P., was made and 1 per cent of formaldehyde added. This has now been standing for two months in a warm place and shows no signs of fermentation.

Experiment No. 5.—Make a thick paste from white dextrin, 4 ounces; and water, as much as required. Then add 8 ounces of flour paste made as in experiment No. 1, and $\frac{1}{4}$ ounce of formaldehyde. This has been setting on the shelf for more than forty days and is as sweet as when first made.

Experiment No. 6.—To paste made as in No 5, but half the quantity of formaldehyde was added. This kept equally well. Thus it can readily be seen that by the use of formaldehyde paste or mucilage can be kept for months.
—*Western Druggist.*

THE MICROSCOPE.

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Ripans Tabules.
 Ripans Tabules cure nausea.
 Ripans Tabules: at druggists.
 Ripans Tabules cure dizziness.
 Ripans Tabules cure headache.
 Ripans Tabules cure flatulence.
 Ripans Tabules cure dyspepsia.
 Ripans Tabules assist digestion.
 Ripans Tabules cure bad breath.
 Ripans Tabules cure biliousness.
 Ripans Tabules: one gives relief.
 Ripans Tabules cure indigestion.
 Ripans Tabules cure torpid liver.
 Ripans Tabules: gentle cathartic.
 Ripans Tabules cure constipation.
 Ripans Tabules: for sour stomach.
 Ripans Tabules: pleasant laxative.
 Ripans Tabules cure liver troubles.

THE MICROSCOPE

JULY, 1896.

NUMBER 43

NEW SERIES

Truth About Microbes.

BY WILLSON D. YOSTLING.

There was a period in the history of the world when "blood-letting" was regarded as a cure for every form of disease; there has also been a period now happily ending, when ethyl-alcohol, in the form of wine, ale or spirits, was supposed to be necessary in the treatment of maladies, and now, in 1896, we are suffering from what I am compelled to call "antiseptiphobia," by which I mean a belief upon the part of the public that most of the ills to which flesh is heir can be cured by the judicious use of microbicides. Indeed, since the establishment of the germ theory of disease, the world seems to have arrived at the conclusion that carbolic acid and similiar preparations possess powers almost allied to magic.

The substitution of the nasty smell of a drug—or chemicals—for the offensive smell of some other character is worthless as far as the destruction of micro-organisms and the prevention of disease are concerned. Further, no disinfectant for rooms can be of much value unless it can be applied to the walls and ceiling, as well as to the contents of the room.

As long ago as 1887, Dr. Alfred Carpenter, of England, condemned the use of carbolic acid, upon the ground that it tends to preserve the dormant germs from decay. Nor is this all, for Dr. George Sternberg, a high authority, has written that "experiments with

carbolic acid show that the popular idea, shared perhaps by some physicians, that an odor of carbolic acid in the sick room and other places is evidence that the place is disinfected, is entirely fallacious." Dr. Sternberg considers the fumes of sulphur and of peroxide of hydrogen reliable disinfectants, in the proportion of 1 volume of either to 100 volumes of air.

In this connection, it may be mentioned that, while micro-organisms require a certain quantity of oxygen to enable them to subsist, yet any considerable addition to that quantity appears, as a rule, to cause death. The inhalation of oxygen, which gas can now be obtained from the atmosphere at a very moderate cost, is likely to be thoroughly tested as an alleviative in lung diseases, and oxy-aerated water will undoubtedly be given a trial in cases of dyspepsia and diabetes.

There are three different classes of micro-organisms. This article deals exclusively with the pathogenic microbes—those which are productive of disease. The other two classes are zymogenic—productive of fermentation, and chromogenic—producing color. Low forms of life (call them animal or vegetable, as you please), such as microbes or micro-organisms, reproduce their species in different ways, some by fission, which is a simple division into two parts, each of those parts eventually becoming a perfect, full-sized adult: others by spores, or buds which grow at the end of prolongations, and ultimately leave the parent, thus becoming distinct individuals. The former variety has been named "bacteria," the latter "bacilli." The distinction between the two is of the utmost importance, because a degree of heat which will inhibit the growth of the most minute bacteria, is not likely to exercise any influence upon the spores of bacilli, although it may temporarily retard, or permanently destroy, the disease producing power of the full-grown specimens.

Every form of life, whether animal or vegetable, flourishes best under certain conditions as to temperature and food, or soil. To this law micro-organisms, of course, conform, and the presence of certain substances in the nourishing medium is essential to the growth of both bacteria and bacilli. Thus, disease-producing microbes do not thrive well if proteids and some organic salts are absent; or if the nourishing material is distinctly acid. Nevertheless, there is reason for believing some putrefactive germs—which must be near relatives to certain pathogenic organisms—are capable of rapid growth in acid medium. In addition, many pathogenic organisms remain inactive unless they are exposed to a certain degree of heat—about the temperature of the human body appears to suit them best—but their growth is quite rapid until from 86° to 100° Fahr. is reached. Heat above 140° Fahr. arrests the growth of many adult micro-organisms, and it may destroy some of them, although it probably has no influence upon the spores of the bacilli.

An “antiseptic” is a substance capable of creating a condition unfavorable to the growth and activity of micro-organisms.

A “germicide” is a substance which will destroy the vital action and the reproductive power of micro-organisms. If, after pathogenic micro-organisms have been placed in a nourishing medium to which carbolic acid has been added, upon the medium being exposed to such conditions of heat and moisture as are favorable to the vital activity of the organisms, the growth is retarded, the conclusion is often reached that the carbolic acid is a germicide, and that the disease-creating power of the microbes has departed for ever. This reasoning is fallacious, because the vital action of the organisms may simply be retarded, in a manner similar to that by which the application of cold inhibits microbic growth. In

order to sustain an assertion that the carbolic acid was anything more than a very mild antiseptic (if it is that), another experiment is necessary. The microbes must be removed and placed in a fresh nourishing substance. If they should then cease to grow, notwithstanding the presence of favorable conditions of heat and dampness, the conclusion would unquestionably be justified that the carbolic acid had injured or destroyed their vital activity.

Before a substance is pronounced a "germicide," bacteriologists take still greater precautions. After the germs have been exposed to the action of the hypothetical germ-destroyer, they are introduced into the bodies of suitable animals—such as are believed to be especially susceptible to the disease under observation—and if, after the lapse of sufficient time, and repeated trials, the disease fails to make its appearance, the substance may be pronounced a germicide, as far as that particular micro-organism is concerned. In cases involving microbes producing spores, the supposed antiseptic cannot be regarded as possessing any valuable germicidal properties unless it destroys the activity, not only of the adult organisms, but also of the spores.

It has already been mentioned that an abundant supply of oxygen is injurious to the activity of disease-producing micro-organisms; and this fact alone is sufficient reason for keeping our houses well supplied with fresh air, both in winter and in summer. A water-closet ought to be an apartment by itself (not a bathroom) of which the window cannot be fully closed, for if it can be shut there is sure to be some ignorant person who will shut it, thus enabling the noxious gases to circulate through the house.

The following facts seem worthy of attention.

Sporeless micro-organisms are destroyed in one and one-half hours at a temperature a little above 212° Fahr

Spores of bacilli require three hours' exposure at a temperature of 284° Fahr.

The most competent authorities appear to believe that heat for less than half an hour at a temperature below boiling point has little influence upon the majority of the disease-producing micro-organisms.

The question so far discussed is the influence of antiseptics upon micro-organisms, and not upon the poisonous alkaloids known as "ptomaines," which, being generated by the microbes, are very often—if not always—the direct cause of disease. While germicides may destroy micro-organic life, nothing, except sufficient heat for a lengthened period, is at all likely to nullify the disease-creating power of the ptomaines. It should be clearly understood, however, that the filtration of water through a filter that cannot be properly cleaned, and the charging of water with oxygen, or carbonic acid—both very good things in their way—are useless as far as ridding the water of disease-producing germs of ptomaines is concerned. Let it be remembered that it is these ptomaines which produce typhoid fever.

Mr. Meillere of Paris has recently recommended the following mixture, as being a true antiseptic and also a pleasant deodorizer.

Zinc sulphate.....	1 pound
Sulphuric acid	35-70 drops
Essence of mirbane.....	15 drops
Indigo.....	to color

Mr. Meillere appears to think that this mixture will satisfy both the scientists and the laity, the confidence of the latter in an antiseptic being dependent upon the presence of a goodly supply of nasty smell, a desideratum which peroxide of hydrogen does not possess. Mr. Meillere's microbe-destroyer being highly poisonous is not of course, intended for internal consumption, but for use in sick rooms, etc.—*Popular Science*.

Geological Distribution of the Foramenifera.

BY ARTHUR M. EDWARDS, M. D.,

NEWARK, N. J.

Foramenifera are widely distributed in geography, being found almost everywhere. They are also widely distributed geologically being found in the oldest rocks and so up to the most recent. And as they are seeming thus universal it is a wonder that they have not claimed and enjoyed a larger part of the labors of the naturalist. It is my wish to endeavor to clear up what is known of them here.

The designation Foramenifera was given by D'Ortigny in 1825 to an order of animals forming minute calcareous shells. They are for the most part many chambered, and often bearing a strong resemblance in form to those of Nautilus, Orthoceros, and other chambered shells or Cephalopods. He supposed Cephalopoda foramenifera to be distinguished from the real Cephalopoda sipunculifera by the want of a "siphon" which passes from chamber to chamber in the latter, and its replacement in the former by mere "Foramana," at the dividing septa. This was where the shells alone were studied without the animals, now that the animals are studied it is found that they must be placed low down in the animal kingdom, in fact at the lowest where the Protista come in. For amœba, the lowest form of the animal, is related closely to the Foramenifera. It was the paper upon living Foramenifera by Dujardin, in 1836, that attention was first drawn to the existence of a type of animals more simple than any previously known, their bodies consisting entirely of an apparently homogeneous semi-fluid substance, to which he gave the name of "sarcode;" and this substance projecting itself through apertures of the shell into indeterminate ramifying extensions (which he termed pseudopodia) in the general mass of the body.

Regarding these animals as a section of the large group of Infusoria, whose bodies he supposed to have a like simplicity of sarcodic composition he distinguished as Rizopods, an account of the root-like diameter of their pseudopodial extensions.

They are found on the shores of New England where I have collected them at Swampscott, Massachusetts in the ripples of the sand at high water where they mark a white ridge and their shells can be got by washing off from the sand. They are also living there, as I have myself seen. On the algæ growing upon the rocks, perhaps they can be got everywhere else by looking for them on the sea weed. The sea weed should be cleaned, not by acids, merely washing it rather violently in a plentiful supply of seawater. The Bacillariariae, Foramenifera and such small fry will thus be washed off the sea weed and letting it stand for a time, can be searched with a dip tube and a common pocket lens for the microscopic atomies.

Dr. Carpenter says they are limited to the shallower seas near tropical shores, but certainly near tropical seas at Swampscott. So I should look for them everywhere away from the ice of the poles. They are found covering the coral reefs, they say, but as yet I have not found them in Florida. Perhaps it is because I have not searched the shores of Florida on the side of the Gulf of Mexico, and perhaps they will be found there by those more fortunate than I have been. In partially inclosed seas, as the Mediterranean and Red Seas also, they have been found. Perhaps the Gulf of Mexico will bear searching. They do not seem to live where the icy water of the North or South affects the sea. Besides, the carbonate of lime which is present in their shells seems to be present in warmer seas. But at Swampscott the Gulf Stream does not seem to bring them. Perhaps it is depleted by Cape

Cod. In enclosed seas we have the largest forms as *obsculina*.

Dr. Carpenter remarks that there is no division of the animal kingdom whose range in time (so far as is at present known) can be compared with the Foramenifera. Looking, indeed, to the vast series of ages that must have been required for the deposit of that long succession of upper Laurentian and Huronian rocks which intervene between the Eozoon limestone of the lower Laurentians of Canada, and in the lowest strata in which the most ancient representatives of the Palæozoic fauna have as yet been found, it may even be said that other fossils are modern by comparison. For the interval between the formation of the Canadian Eozoon and the period represented by the oldest fossils of the Lower Cambrian series seem undoubtedly to have been quite as great—geologically speaking—at that which intervened between the latter and the existing epoch, if not greater, the “fundamental gneiss” of Sir Roderick Murchison, which represents in central Europe the Laurentian of Canada, and near the base of which is found the kindred Eozoon bararicum, having a thickness estimated at 90,000 feet, and being overlaid by a great thickness of other non-fossiliferous rocks. Hence the determination of the organic origin of this *Ophicolcite*, and its Forameniferal affinities, which has been affected by the examination and comparison of parts of specimens so minute as to be scarcely visible to the naked eye, must be considered as one of the most remarkable results of microscopic research—fully equal in importance, when considered in all its bearings, to the discovery of Prof. Ehrenberg of the Forameniferal origin of the chalk.

As Prof. Gumbel says “The discovery of organic remains in the crystalline limestones of the ancient gneiss of Canada, for which we are indebted to the researches of

Sir William Logan and his colleagues, and to the careful microscopic investigations of Drs. Dawson and Carpenter must be regarded as an opening of a new era in geological science."

Note On An Optical Rule.

BY EDWARD M. NELSON, F. R. M. S.

The rule is made of box, is 20 inches long and square in section. On one face there is a scale of inches and tenths, and on the opposite side centimetres and millimetres. On one side of the sides at right angles to these is a scale of dioptries marked D, and on the remaining side opposite to it is a new scale of powers of marked P. All the scales read from the same end and are ruled on both edges of the rod. This is important, because any two continuous scales can be read and compared together: thus dioptries can be converted into inches by the inspection of one edge of the rod, and into centimetres by viewing the other, and vice versa. On the opposite face of the rod the scale of powers can be treated in a similar manner. The following are some examples of the use of the rule:—

(1). When the focus of a lens is measured on the P side of the rule, its magnifying power, when the eye is held at the back principal focus, is indicated. By adding one to this figure the power, when the eye is held close to the lens, is found; but if one be subtracted from it, the enlargement of an image on a screen distant 10 inches from the lens will be enlarged three times.

(2). When the power of any lens is known, its focal length can be determined by inspection, either in inches or mm. Thus a lens of two-power has a focal length of five inches or 127 mm.

(3.) The focal length of a diverging lens can be easily found by overpowering it with a converging lens and measuring the power of the combination; this power, less

the power of the converging lens, is the power of the diverging lens. Its focal length can then be determined in either inches or mm., by inspection. Example: The power of a double concave, when combined with a bi-convex, is 0.85, as measured on the P side of the rule. The power of the bi-convex alone is 3.0; then 0.85, minus 3.0, equals minus 2.15. The focal length of the double concave is therefore minus 4.65 inches or 118 mm., these being the figures in a line with 2.15 on the rod.

(4.) The rule is very useful as a ready reckoner. Example (A): A lens of $8\frac{1}{2}$ inches focus is combined with one of 94 mm. focus—required the power and focus of the combination in inches and mm., $8\frac{1}{2}$ inches is in a line with 1.175 P, and 94 mm., in a line with 2.7 P. The power of the combination is, therefore, 1.175, plus 2.7, equals 3.875; this is in a line with 2.58 inches and 65.3 mm., the foci required. Example (B): I have a lens 178 mm. focus—what must be the focal length of the lens in inches that added to it will yield a power of 5? In a line with 178 mm., is 1.425 P; then five minus 1.425 equals 3.575, the power of the lens required; this is in a line with 2.8 inches, which is its focal length.—Quekett Microscopical Club Journal.

Reduction In Sulphates.—*Spirillum desulfuricans* is the name of an organism obtained by Beyerinck from ditch water which has the property of reducing sulphates. It is a short spirillum, actively motile, but its motion ceases when oxygen is applied.—Arch. Neerland.

Does Tuberculin Accelerate Tuberculosis in Animals.—Prof. Nocard, the French veterinarian says: "The aggravation of tuberculosis lesions under the influence of tuberculin is a common fact in man, it is exceptional in bovines. I have observed but three cases out of 3500 injections that I made myself, and besides, when it takes place it is always upon animals with phthisis to the last degree and consequently useless."—American Veterinary Review.

THE MICROSCOPE.

New Series, 1893.

For Naturalists, Physicians, and Druggists, and Designed to Popularize Microscopy.

Published monthly. Price \$1.00 per annum. Subscriptions should end with the year. The old series, consisting of 12 volumes (1881-1892), ended with December, 1892. Sets of the old series cannot be furnished. All correspondence, exchanges, and books for notice should be addressed to the Microscopical Publishing Co., Washington, D. C., U. S. A.

CHARLES W. SMILEY, A. M., EDITOR.

EDITORIAL.

Transactions of the Kansas Academy of Science.—The transactions of the twenty-sixth and twenty-seventh annual meetings of this scientific society, bound in a 400 page book, have just been received. This volume, XIV, edited by the librarian, is of unusual interest. Besides "Small Things," address of the retiring President, Prof. E. S. Bailey, Lawrence; many valuable articles on geology, mineralogy, botany, etc., have interested us. In comparing the back numbers we find that the last one is certainly better than any other. The Kansas Academy is gradually becoming recognized by the best societies and scientific institutions of the world, and has for correspondents the prominent professors of all continents.

Field Flowers.—This is the title given to a beautiful book containing some of the most popular poems of Eugene Field. Thirty artists, the leading illustrators of America have very kindly donated their services in illustrating the work throughout. The book is published for the purpose of creating a fund, the proceeds of which will be equally divided between the family of the poet and the fund for the erection of a monument to his memory. Price \$1.00; ten cents additional for postage. Address Eugene Field Monument Souvenir Fund, 180 Monroe street, Chicago.

PRACTICAL SUGGESTIONS.

By L. A. WILLSON,
CLEVELAND, OHIO.

Puccinias.—This form of fungus is now rapidly ripening. They comprise something over a hundred species. They are known as mildews or brands and attack and are found growing on a great variety of plants.

It is a matter of commercial importance to identify them and destroy them as they work havoc with crops of cereals and other valuable plants. No two species have spores alike; in this respect they rival diatoms for the microscopic student; besides they need no cleaning or manipulation. Finding an infected plant, scrape a little of a pustule, with a spatula, transfer to a drop of water on a slide, cover and examine with a quarter objective. If you are acquainted with this fungus purchase a lot of specimens from a dealer in microscopical supplies; most dealers have packages containing forty or fifty specimens which are sold very reasonably. Some of the spores are very beautiful.

Spot Lens and Paraboloid Illuminator Effects.—Nearly all the beauties of a spot lens or a paraboloid illuminator can be obtained by the use of oblique illuminator with a low power. Butterfly scales, scales of synapta, pollen grains and in fact nearly all objects may be beautifully exhibited by oblique illumination. This effect is well accomplished by turning the mirror aside from the axis of the microscope.

Arsenic.—The microscope is often an indispensable aid, in some of the tests for arsenic. The most common form of the crystal is octohedral or tetrahechol, but a right rhombic form may be obtained by sublimation. Protoxide of antimony will also yield by sublimation similar crystals. The crystals may be seen with the microscope to the 10,000 of a grain. In Marsh's test metallic arsenic is formed in the upper part of the test tube, which may be examined under the microscope. Sulphuretted hydrogen precipi-

tates the arsenic in a rich orange color and the antimony of an orange color. The yellow tint is apparent when only a one ten-thousandth part of arsenious acid is present.

Daldinia Concentrica.—Nearly every one who has wandered in the woods has observed on rotten wood little sub-spherical, hemispherical or long ovoid excrescences from one quarter to one half an inch in length. They are black spotted and resemble miniature plum puddings of the fairies dotted with tiny raisins. The excrescences are a fungus of the order Pyrenomycetes, sub order Dothideaceæ, genus *Daldinia* and species *concentrica*. The excrescences are the stromas.

To examine the plant cut the stromas in half with a sharp knife. The inner arrangement will be seen to consist of concentric layers. Place one of the severed halves under a dissecting scope.

In the top will be found a sort of a honey-combed layer composed of the perithecia; inside of the latter the asci will be found; they appear like masses of white jelly. Remove a few of the latter with a spatula to a drop of water in a slide; with forceps remove all dark woody and corky pieces and leave nothing but the white jelly-like masses. Cover and fill the space under the cover with a drop of water and examine with a quarter objective. The long pedicillate asci will then appear; in each ascus will be seen eight brown spores. The contrast between the brown spores and the hyaline acid will be exceedingly pleasing. The spores will be noticed to be obliquely uniseriate or arranged one spore overlapping the other in a single row. The little raisins on top of the pudding are the ostioles. A good picture of this strange and interesting plant may be found in plate 38 of *North American Pyrenomycetes* by Ellis and Everhart.

Blood in Urine.—May be suspected if the urine has a smoky or reddish-brown appearance, and may usually be detected in a satisfactory manner by the microscope showing blood corpuscles (these often do not show their characteristic biconcave appearance).

SCIENCE-GOSSIP.

Flax Retting and its Microbe.—M. V. Fribes in the laboratory of M. S. Winogradsky has determined the cause of this interesting industrial process. The organism causing the separation of fibers is a large bacillus 10-15 mm. long and 0.8 mm. broad. It produces a large tadpole spore 1.8 mm. by 1.2 mm. It was obtained in pure culture by cultivating the organism under anaerobic conditions on boiled potatoes containing chalk. The organism does not act on cellulose, it however ferments glucose, saccharose, and lactose, and starch when peptone is present. Experiments made showed that it had retting power.—Comptes Rendus.

A Disease of Melons. (*Alternaria* sp.)—Late in August specimens of musk-melon leaves were received at the station from Mr. S. B. Wakeman of Saugatuck. The leaves were evidently diseased, and Mr. Wakeman wrote that the trouble was spreading very rapidly over his melon ground notwithstanding applications of Bordeaux mixture. A visit to Saugatuck confirmed Mr. Wakeman's report. Of three large fields of melons, one was completely ruined, and the other two showed abundant evidences of disease. The trouble seemed to start at the center of the hills and extend rapidly outwards. It was characterized by a wilting of the leaves, followed by the appearance of small yellowish spots and blotches; these increased rapidly in size, the surface of the diseased areas became marked with dark, concentric rings, the tissues became dry and brittle, and upon all the older spots there was a copious growth of black mould distinctly visible with a lens. Microscopic examination showed that the leaf-tissue in every diseased spot was traversed by delicate, colorless threads, which, coming to the surface either singly or in little erect tufts, gave rise to short chains of large, brown, club-shaped spores, provided with a long erect appendage, and serving to place the fungus in the genus *Alternaria*. No other fungus was found in connection with the trouble, and this

together with the fact that the *Alternaria* was found abundantly in every one of the diseased leaves examined, produced a strong impression that the disease was due to the fungus in question. There was no opportunity however, to prove this supposition by the inoculation of sound leaves with a pure culture of the *Alternaria*. When the field was first examined, late in August, the plants had received two applications of Bordeaux mixture, but it had not been applied very evenly. The only thing to be done under the circumstances was to recommend another immediate and thorough application of Bordeaux mixture, especially upon those portions of the vines at a distance from the centre, which as yet showed no symptoms of the disease. There was but little hope however, of saving the crop to any great extent, and as the result proved, the disease continued to spread even after thorough treatment of the vines with Bordeaux mixture.

There are a number of fungi which are known to affect the leaves of melons, but the one in question is probably identical with the species of *Alternaria* recently described by Smith and by Peglion as affecting melon-leaves in this country and in Italy. Whether in this case the fungus was a true parasite, or whether it merely followed an injury due to other causes, must remain an open question for the present.—*Exchange*.

Chloral Carmine.—The following makes a beautiful and permanent carmine useful in almost every kind of work, and especially so in animal histology:

Carmine, No. 40.	50 cgm.
Alcohol	20 ccm.
Acid hydrochloric.....	2 ccm.
Chloral hydrate.....	25 gm.

Mix and dissolve.—*Nat. Druggist*.

The Lepra Bacillus has been found in the blood, as well as in the tissues, by Dr. Bouffe, of Paris.

Epithelium in Urine.—Under the microscope this is seen as irregularly shaped bodies.

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 Ripans Tabules cure torpid liver.
 Ripans Tabules: gentle cathartic.
 Ripans Tabules cure constipation.
 Ripans Tabules: for sour stomach.
 Ripans Tabules: pleasant laxative.
 Ripans Tabules cure liver troubles.

THE MICROSCOPE

AUGUST, 1896.

NUMBER 44

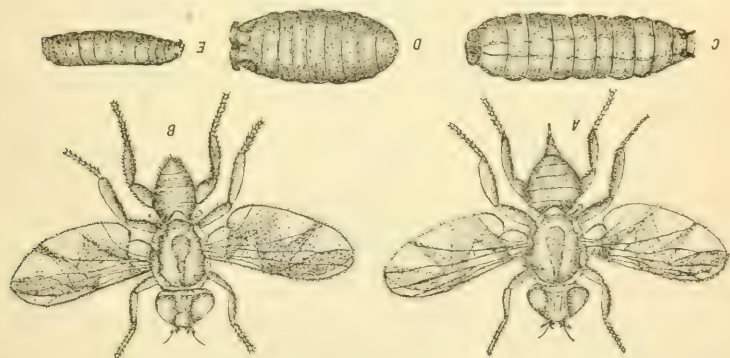
NEW SERIES

Objects Seen Under The Microscope

BY CHRYSANTHEMUM.

XXXIII.—TRYPETA POMONELLA OR APPLE MAGGOT.

One of the most troublesome apple pests and one which is increasing every year is the apple maggot, commonly known as the railroad worm. The parents are two-winged flies (figs. A B) which remain in the ground in a pupa state (fig. D) during the winter, emerge in June or July according to the climate and are on the wing until

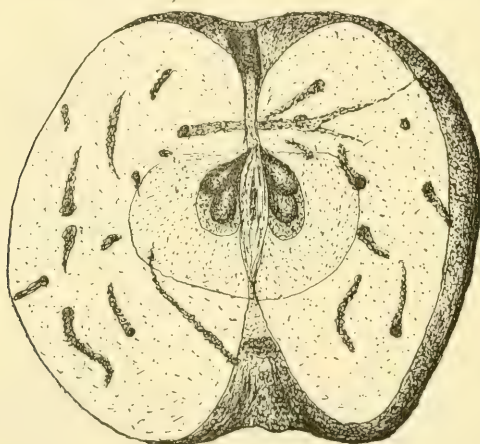


September or October, or until the early frosts check them.

If some of them are captured, by confining them in a gauze bag placed over a branch of the tree, it will be of interest to watch them. The female (fig. A) will commence to lay her eggs in the half grown fruit by puncturing the skin with her ovipositor and inserting the eggs vertically into the pulp of the apple with the end which contains the head pointed toward the core. The

eggs are deposited in all parts of the apple, usually upon the cheeks, sparingly near the calys and stem ends, and more abundantly upon the pale or shaded side of the fruit. The eggs are developed successively in the ovary of the female, after the manner of the barn yard fowl, and the season extends over a considerable time, each female laying from three to four hundred eggs and the time required to deposit an egg is about one half minute. In confinement a female will live three weeks.

By means of the sharp ovipositor a puncture 3 m.m. (.0133 in.) in diameter, is made through the skin of the



F

apple. These punctures can be detected, by careful observation by the naked eye, but a pocket lens is necessary to see them well. They appear as brownish specks not readily distinguished from the rusty spots common on apples. Under the glass they appear as circular or oblong openings, surrounded by a brownish border, somewhat shrunk by the shriveling of the tissues beneath. They may be numerous on the same apple.

The eggs hatch in four or five days under favorable conditions and the minute larvæ (fig. C) begin at once to

work in the pulp of the apple. They have no true opposable jaws, but the head is provided with two black curved hooks, situated above the mouth, with which they rasp the pulp of the fruit rapidly by means of a vertical movement of the head. They live upon the juice of the particles of apple thus detached, which is sucked into the mouth. Although they have no feet they can burrow their length in soft fruit in less than a minute. The channels made by the young larvæ, while the fruit is still growing, are largely healed and neither they nor the minute white larvæ are likely to be detected by the casual observer. As the larvæ grow, and the fruit matures, the enlarged channels do not heal, but turn brown and the presence of the maggots (fig. E) is then readily detected.

These channels meander through the whole fruit, even the core (fig. F.) They often cross each other, enlarge as the larvæ grow, and finally they involve the whole fruit. When the apples fall to the ground the maggots crawl into the soil and go into the pupa state (fig. D) in which they remain all winter.

The best way to check the increase of this insect is to pick up the windfalls each day and either bury them one or two feet below the surface or feed them to the cattle, being careful to give no more than will be eaten up at each meal, thus preventing the next year's crop of flies, and, as the flies are sluggish, each farmer can protect his own crop. An extra precaution is to turn the hens into the orchard. At one of the experiment stations it has been estimated that there were from 1600 to 12000 pupa under a single tree.

Walter White Objects.—Prof. L. W. C. writes: "Will you please send me as full a list as you have in stock of the Walter White objects. A friend of mine has been recently mounting some of them in my laboratory and I like them so well that I want to secure all that I can get."

Note on Calcareous Algæ from Michigan.

D. P. PENHALLOW.

MCGILL UNIVERSITY, MONTREAL.

In the latter part of the summer of 1891, Sir Wm. Dawson received from Mr. B. W. Thomas, of Chicago, some very curious and interesting calcareous pebbles formed by algæ. They were transferred to me with the request that I should report upon the nature of the organisms giving rise to them. These pebbles were found in considerable numbers in certain Michigan ponds by Dr. J. W. Velei, secretary of the Chicago Academy of Natural Sciences. The specimens were found on a smooth, sandy bottom, under about four feet of water, and the collector states that when fresh "they had so soft and slippery a feeling" that he thought they were alive. Those which reached me were said to be representative of the average size. They were found to be irregularly ellipsoidal with a thickness of about 40mm. and a diameter of about 60x80mm. Light ashly gray, the surface was found chiefly smooth, but here and there with depressions of various sizes, frequently merging into actual cavities. The pebbles are not solid, but appear as a thickish shell-like mass surrounding an irregular cavity, such as might be conceived to arise from a progressive internal decay, concurrently with an extension of the mass from without.

Upon treating a portion of a pebble with acid to remove the incrustation of lime, it became evident that we had to deal not with an individual organism, but with a community possessing considerable diversity of plant forms, while it was also evident that the growth of the mass had involved the inclusion of a variety of foreign bodies, some of which at least, might have served as a base for the algal growth.

From my notes taken at the time, it appears that owing to the imperfect condition of some of the plants, it

was not possible to determine them conclusively in all cases. There were found, however, numerous diatoms, fragments of *Œdogonium*, *Gleocystis*, *Calothrix* and *Urococcus*, and in much larger quantity, plants of *Siro-siphon informe* Kg. Pine pollen and fragments of coniferous wood were also noted as common inclusions. The body of the specimen was found to consist of a plant which could not be satisfactorily determined. The material was therefore referred to Dr. Farlow, who not only confirmed the observations previously made, but ascertained that the dominant species was *Diclothrix gypsophila* (Ag.) B. & Flk. From the facts thus noted the inference was drawn that the pebbles might be regarded as veritable museums which would probably disclose some new form each time a fresh examination was made.

More recently some of these pebbles were sent to Mr. E. Grove, of England, who in turn transferred them to Mr. George Murray, of the British Museum. Mr. Grove undertook the determination of the diatoms, and has added considerably to our knowledge of the composition of these curious communal growths, by the publication of a list embracing 24 genera and 100 species and varieties. This somewhat extensive diatomaceous flora is, nevertheless, hardly to be regarded as playing any special role in the formation of the pebbles beyond the fact of simple association, a relation which is readily understood when we recall the very universal distribution of these minute organisms, and the readiness with which they take up their abode in almost any situation.

The larger forms of plants found in the pebble were determined by Mr. Murray, who has given, in addition to other figures, excellent drawings showing the general external characteristics of the pebbles. His determination of the components showed that, "the predominating kind was clearly a species of *Schizothrix* while mixed

with it there were other forms, notably filaments of *Stigonema* and *Dicothrix*."

Not arriving at a satisfactory conclusion respecting the first, Mr. Murray referred the matter to M. Gomont as final authority, who reported that, "the interior of the calcareous mass is formed of entangled filaments; they appear to belong to a *Schizothrix*, but which?" Finally he says, "I do not think one can make anything very distinctly out of this specimen except *Schizothrix fasciculata*, which undoubtedly occurs in abundance." Excellent figures of this plant are given by Mr. Murray.

It would thus appear that from two independent sources we have results which, while agreeing in many respects, fail to agree as to the character of the dominant plant, and the idea derived from the observations of Dr. Farlow and myself, that there is no element of constancy in the composition of the flora of these pebbles, beyond the fact that two or three species are in excess, would thus seem to be greatly strengthened.

Apart from the species found in the pebbles, but which could hardly have played any part in their original formation, it will be seen that there are present two and perhaps three species which, by their concurrent growth, may have produced them. It would be of great interest to know whether these large concretions are due to the growth of a single species, or, if to the combined growth of several species, the relative part which each plays. It is, therefore, to be hoped that some observer will watch the locality and obtain quite young material which alone will afford the means of settling this interesting question.—*Botanical Gazette*.

General Index.—This General Index is received with very much pleasure by the subscribers. Dr. R. H. W. says: "It is excellent, and evidently cost you a great deal of labor, it adds greatly to the value of the set of books."

Odontophores and their Preparation.

BY ARTHUR M. EDWARDS, M. D.,

NEWARK, N. J.

I do not find anything about odontophores and their preparation in the journals devoted to microscopy, or at least very little, and as I have devised a method, now new, perhaps, for their preparation which I will detail it here.

On the 10th of June, 1870, I captured a living specimen of *Helix memoralis*, a European species of snail, on a sidewalk in New York City. The fact was strange, as it was a stranger in the land although common in Europe. How it could be introduced could not be ascertained, but if it could thus get loose, many might also, and the species become common in this country. This led me to detail my process of preparation at the next meeting of the Lyceum of Natural History and as the process is easy to work and specimens are very nice, I wish to give it now.

There is however something about odontophores and the head of patates of cephalophorus molluscs in Carpenter's treatise on the microscope, and he says about the preparation about this. The preparation of these palates for the microscope can, of course be only accomplished by carefully dissecting them out from their attachment within the head; and it will be also necessary to remove the membrane that forms the sheath of the tube, when this is thick enough to interfere with its transparence. The tube itself should be slit up with a pair of fine scissors through its entire length, and should be so opened out that its expanded surface may be a continuation of that which forms the floor at the mouth. The mode of mounting it will depend upon the manner in which it is viewed. For the ordinary purposes of microscopic examination no method is so good as mounting

in fluid, either weak spirit or Goody's solution answered very well. But many of the palates, especially those of the marine gastropods, become most beautiful objects for the polariscope when they are mounted in Canada balsam, the form and arrangement of the teeth being very strongly brought out by it and a gorgeous play of colors being exhibited when a selenite is placed behind the object, and the analysing prism is made to rotate."

This is all very well for the novice in microscopy but I think I can show a better way for preparing odontophores. Let us suppose we have a *Helix*, like that mentioned as caught above, or a *Limnaea* or *Physa* or *Planorbis* which are so common everywhere. We have but to put the shell containing the animal alive into boiling strong caustic potash and bring it to a boil. The strength of the potash solution must be suited to the animal, some being destroyed, and the odontophore also, by strong solution, then wash it in water. All will be dissolved but the shell and the odontophores. This can have the shell taken out and the odontophore searched for by holding the vessel in which the boiling has gone on, up to the light. The odontophore will be seen to be floating about and flashing by reflected light. It can be taken out with a pipette and thoroughly washed. It is then put on a slide and arranged by means of two needles put into handles. I find the needles can be thrust into matches, the end with the eye in it first, and the front end used. When the odontophore has been arranged any preservative having glycerine in it cannot be used, for glycerine is liable to dissolve any time in the substance as Carpenter showed. So the odontophore must be dried on the slide and the cover put on afterwards. A ring of gold size being put around the preparation and dried before the cover is put on, or gum thus is used to mount it, and I find gum thus is excellent, much better than balsam and showing the colors with polarized light

nically. Thus the odontophore can be mounted well and shows its characteristics in an extremely fine manner. I do not think ordinary odontophores can be worked nicer than this. Of course many will have to be dissected out but the cleaning by means of caustic potash or soda answers very well.

EDITORIAL.

A Suit for Contracting Typhoid Fever.—The following extract from the Medical Age is significant, showing as it does, how rapidly the public is learning that disease may be controlled or even prevented by the proper observance of hygienic laws. The old notion that every case of sickness or death is due to a wise dispensation of Providence instead of a violation of natural laws, is becoming obsolete.

The widow of a man who recently died of typhoid fever in Ashland, Wis., brought suit against the Ashland Water Company for \$5,000 damages, alleging that the corporation permitted the water to become polluted with typhoid germs, and that her husband's death was due to this pollution.

There is little doubt that suits of this kind will, in the future, increase, and that damages will in many instances—and should in the majority—be obtained.

The City of Windsor, Ontario, is at the present moment suffering from the ravages of typhoid, and the epidemic is daily increasing, simply because the city government has for two years refused to take appropriate measures to prevent the sewage from the Walkerville suburb from being drawn into the city's water supply; even an efficient health officer and health board were removed because they insisted on looking after the welfare of the people, and an incapable officer and inefficient board appointed who are amenable to the criminal negligence and penuriousness of the Common Council.

Now, the Provincial Health Board has taken a hand in the matter, and it remains to be seen whether a city council can continue to wantonly jeopardize the lives of the people.

QUESTIONS ANSWERED.

NOTE.—*Dr. S. G. Shanks, of Albany, N Y., kindly consents to receive all sorts of questions relating to microscopy, whether asked by professionals or amateurs. Persons of all grades of experience, from the beginner upward, are welcome to the benefits of this department. The questions are numbered for future reference.*

241. My polarizer is made of cover glasses No. 2. In cleaning them I break many. Can I use covers one fiftieth inch thick for polarizing? WISTARIA.

Yes, but the thicker glasses will transmit somewhat less light.

242 Can you explain in a simple way why objects are colored? WISTARIA.

Color is a quality of the light which illuminates an object. Without light there is no color. An object in the light appears to have a color when it reflects that color and absorbs or transmits all the other colors. When an object reflects all colors, it is said to be white.

PRACTICAL SUGGESTIONS.

BY L. A. WILSON,

CLEVELAND, OHIO.

Excessive Mounting.—It is a waste of time and energy to attempt to mount too many things. It is more a nuisance than a benefit to have too many slides in a cabinet. Many objects may be better examined in a natural state than when mounted. Such specimens may be kept in papers and boxes and examined as occasion may require.

In this list I would include spores, fungi, pollen grains, lichens, mosses and a host of similar preparations.

Larbaragues Solution.—Where the staining process is to be employed, the substance should be previously bleached. For bleaching the above solution is one of the best and most convenient for the microscopist. The solution is also known as chlorinated soda liquor, sodae chloratae, and disinfecting fluid.

The fluid may be prepared as follows :

Chlorinated lime twelve troy ounces, water twelve pints.

Dissolve the carbonate of soda in three pints of water, with the aid of heat. Triturate the chlorinated lime, a little at a time, with small portions of the water, gradually add until a smooth uniform mixture is obtained. Mix this intimately with the remainder of the water, and set the mixture aside for twenty-four hours.

Then decant the clear liquid, and, having transferred the residue to a muslin strainer, allow it to drain until sufficient liquid has passed to make, with the decanted liquid, eight pints. Mix the liquid thoroughly with the solution of carbonate of soda, transfer the mixture to a muslin strainer, and allow it to drain, adding water if necessary toward the close, until eleven pints and a half of the liquid have passed. Lastly put in bottles well stopped, with glass stoppers, in a cool dark place.

Mounting Hydra.—Fresh specimens are infinitely more interesting than any mounted one can possibly be, but they may be mounted. To mount them place in a cell filled with water and cover. Watch when the tentacles are expanded; at this moment hold the slide over and close to the chimney of a student lamp. This latter process will kill the animal and prevent the retraction of the tentacles. Then remove the water from the cell with a blotter and fill the cell with a solution of chloral hydrate. The mount may then be sealed and the animal preserved indefinitely.

It is said that an osmic acid solution will kill the animal without retraction or shrinking.

Carpenter recommends a mixture of nine parts of a one fourth solution of chromic acid with one part of a one per cent solution of osmic acid and says that after being subjected to the agent the specimen should be treated with fifty per cent alcohol gradually increased in strength to absolute. This latter agent is said to be applicable for fixing and preserving infusoria, rotifera, desmidiceae, diatomaceae, bacteria and other delicate vegetable and animal structures.

SCIENCE-GOSSIP.

"Spitting" in Indiana.—The Indiana State Board of Health has issued a circular letter to all railroad officials asking them to have ejected from their trains every man who persists in spitting on the floor of the cars or stations after he has been warned not to do so. In the circular the board explains that the sputum contains the germs of la grippe, nasal catarrh, and various other diseases. It also declares that "spitting is a nasty and unnecessary habit," and explains that the Board of Health will pass a rule against spitting which will have all the force of law if the railroads will post it up and endeavor to enforce it. The circular adds: "When the rule is first published and posted up in public places this board will, of course, be loudly abused as foolish, impracticable and idiotic. Attention thus being gained, we will publish in every county reason for the action." "Such a reform as the Indiana health officers have undertaken is needed in every part of the United States.

Ulcerative Endocarditis Caused by the Gonococcus—Gonorrheal Septicemia.—Thayer and Blumer (Bulletin of the Johns Hopkins Hospital, April, 1896) give a resume of the literature bearing upon the subject, and report a case in which bacteria corresponding in every way to the gonococcus were found in the vegetations on the mitral valves. The valvular lesions were typically those of acute ulcerative endocarditis. Cultures made during life from the blood which was removed by a sterile syringe from the median basilic vein gave a diplococcus, identified as the gonococcus. The cultures were made by mixing a large quantity of blood with liquefied nutrient agar-agar, by a method corresponding to that of Wertheim.

The Dangers of a Scratch.—Scarcely a day passes that many persons in some way or other, get a scratch, a small cut, or a bruise that may break the skin. In most instances not the slightest attention is paid to this beyond the temporary annoyance of the pain and the possible irritation when the hands are put into water, or some subse-

quent blow in the same spot brings an exclamation on account of the hurt. This, while a common practice, is by no means a wise one. The air is full of floating disease-germs, especially the air of cities and towns, and an injury of this sort, be it ever so slight, might furnish excellent breeding ground for some deadly bacteria. It is a good plan always to keep a bottle of prepared carbolic acid and glycerine, and frequently touch all bruises or sore spots with it. This is one of the most convenient and effective germicides imaginable. It is believed that many cases of fever and other serious ailments can be contracted by a floating germ coming in contact with the abraded skin. Once snugly lodged in this most congenial dwelling place, the germ multiplies with amazing rapidity and soon overruns the entire system. Therefore, whenever there is a bruise or scratch, or any injury of this sort, germicidal applications should be at once resorted to. *English Mechanic*.

Air in Paris.—Not infrequently the pursuit of microbe and germ theories leads people to absurd conclusions. In the *Annales de Micrographie*, M. Miquel gives statistics for ten years of the numbers of bacteria in a cubic metre of air, both in the centre of Paris and in the park of Montsouris. In consequence of local improvements, the air in the park has gradually become purer, the number of bacteria having decreased from 480 per cubic metre in 1884 to 275 in 1893; but the air in Paris itself has increased in micro-organisms from 3,480 in 1864 to 6,040 in 1893. This large increase, Nature says, M. Miquel attributes to the greater cleanliness of the inhabitants, who by dusting out and cleaning their houses and shaking carpets, &c., stir a large quantity of germs into the air. He even goes so far as to condemn this form of cleanliness, on the ground that the germs are simply blown about by the wind, and find their way into the houses again, so that if you do not get your own germs back, those from your neighbors fly in at the window instead.

Butter from Sterilized Milk. A machine has been invented by a Swedish engineer which will transform steri-

lized milk into butter in one minute. Not only is time saved, but the butter is made absolutely pure and free from germs. The milk is heated in the sterilizer to 160 degrees F. From the sterilizer it runs into a churning chamber, where it is cooled down to 60 degrees in its progress, by means of very small cooling frames, through which iced water constantly passes, and which revolves with the churning chamber at the rate of six thousand revolutions a minute. Several advantages are claimed for this remarkable machine, which bids fair to create a revolution in butter-making upon a large scale. In the first place, by sterilizing the milk, disease germs, if they are in it, are destroyed, as well as the microbes which cause putrefaction of the butter. The process of butter making is so rapid that there is very little chance of any germs that may exist in the atmosphere of the dairy getting into the butter, especially as all, or nearly all, air must be forced out of the chamber of the machine by the extreme rapidity of the movement going on inside. When the butter is once pressed, the possibility of germ impregnation is almost eliminated. Thus a wholesome and permanently pure butter is produced. Another advantage is that milk can be converted into butter directly after being obtained from the cow.—*Med. News*.

A Cheap Polariscopes.—The following cheap polariscopes will be found to give first-class results:—Cut 20 to 25 pieces of thin glass, 18mm. by 12mm. Now make a cardboard tube from a marked card, as shown below.

The pieces of glass should now be fixed in tube with strips of card shown in sketch. If all is done right, the glass will be at an angle of 35 degrees. Of course, two may be required. The square tube can be fastened in a round tube to fit the microscope.—*Eng. Mechanic*.

Dirty Thermometers.—Those who are constantly preaching the germ causes of disease are the very fellows who many times are as careless as their unbelieving friends. How frequently do we see physicians take the temperature of their patients, regardless of the existing

disease, wipe the instrument with their handkerchief, which is the linen most liable to be full of germs, or a towel, or even use the sheet, and carefully place it away in a case prepared with a small amount of absorbent cotton in the bottom to keep from breaking, and unintentionally preserving the germs from time to time, to be conveyed to the next unfortunate who may be the first patient called upon. This seems to be a very simple thing to discuss, but any reasonable person can readily see the necessity of having his thermometer thoroughly cleaned every time it is used. It should be washed with soap and water, and if any cotton is used in the bottom of your case, let it be sublimated cotton, and occasionally renew it.—*Medical Record*.

NEW PUBLICATIONS.

The Laryngoscope.—We have just received No. 1, vol. 1, of the *Laryngoscope*, a journal devoted entirely to the consideration of diseases of the nose, throat and ear. It is a monthly and it is published in St. Louis, Mo.—*Scientific American*.

Micrometallography, as its name implies, deals with the microscopic examination of sections of metals. It promises to be of great practical use to the metal worker, for by its means those mysterious fractures in steel, with which every engineer is familiar, are explained. Under the microscope the steel used by engineers can be thoroughly and carefully examined, and the steel "cells" tested. Flaws in the interior of metals can be detected by the microscope, and thus many accidents can be prevented.

The 50th anniversary number of the *Scientific American*, just out, is a handsome and valuable publication of 72 pp. It reviews the progress of the past 50 years in the various sciences and industrial arts; and the various articles by the best scientific writers of the day are racily reviewed and richly illustrated. The editors have accomplished the difficult task of presenting a compendium of information that shall be at once historical, technical and popular. The story of the half century's growth is in itself a veritable compendium of valuable scientific information for future reference. Price 10 cents per copy.

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THE MICROSCOPE

SEPTEMBER, 1896.

NUMBER 45

NEW SERIES

Objects Seen Under The Microscope

BY CHRYSANTHEMUM.

XXXIV.—OYSTER SHELL BARK LOUSE AND SCURFY BARK LOUSE.

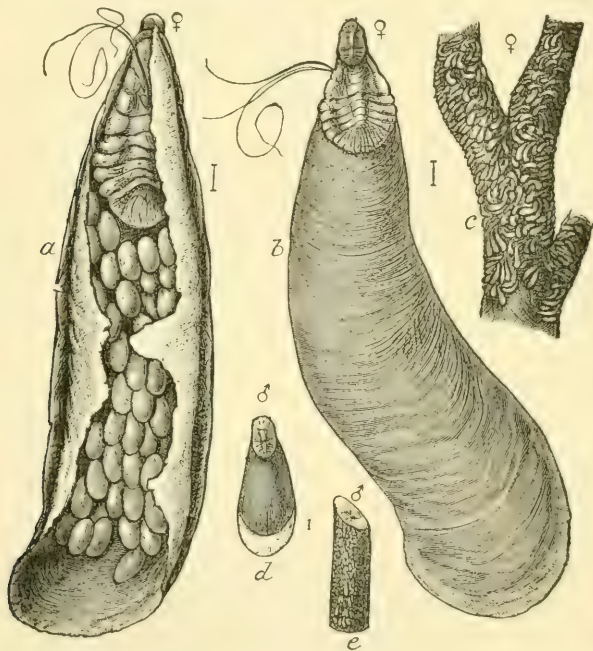
The Oyster Shell Bark Louse is found upon the apple, pear, quince, hawthorn, buckhorn, raspberry, currant, linden, hop tree, bladder nut, horse-chestnut, maple, water locust, honey-suckle, ash, elm, willow and others. It has somewhat the shape of the oyster-shell, and generally attacks the young twigs or trunk of the tree. They are sometimes, though rarely, found on leaves or fruit. This in northern countries would mean certain death as they there have but one brood in a season, but in the south they have two broods.

If, during the winter, one of the scales be lifted, it will be found to contain the shriveled body of the dead female, under the more pointed portion of the scale, while behind this, the scale will be seen filled with eggs, white unless near the hatching period, which in the northeastern states is in May or early June, when they will be yellow. The eggs vary in number from 42 to 86 and when hatched, the young wander upon the twigs, and settle at once and commence to form the scale.

After inserting its beak and settling, the female molts twice, and begins the formation of the scale, which is secreted mainly from the hinder portion of the body and extends backwards. The insect has two molts and the

two cast skins remain in an overlapping position on the anterior portion of the scale.

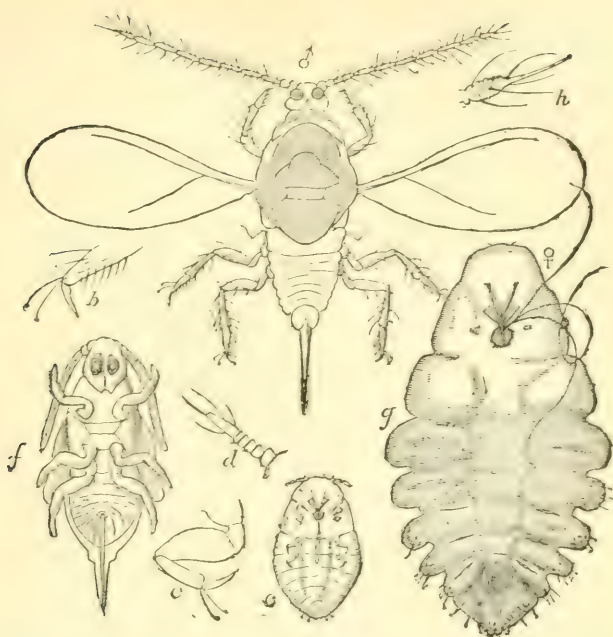
The male scale is much smaller than the female, as indicated in the figures, and is otherwise distinguished by a few structural peculiarities. In the first place, there is but one cast skin at its anterior extremity, and in the next place, the hinder portion of the scale is hinged in



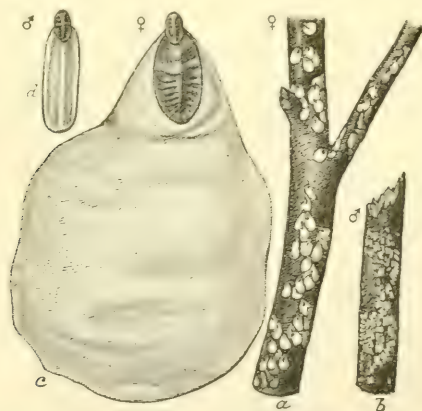
Mytilaspis pomorum or Oyster Shell Bark louse: a, female scale from below showing eggs; b, same form above greatly enlarged; c, female scales; d, male scale-enlarged; e, male scales on twig—natural size.

such a way that it lifts up like a flap, permitting the escape of the adult male. The different stages and structural details of the insect are so well shown in the figure as to require no further description.

SCURFY BARK LOUSE.—This scale insect occurs abundantly upon apple and pear trees, also on quince, black-cherry, currant and mountain ash, also on the Japan

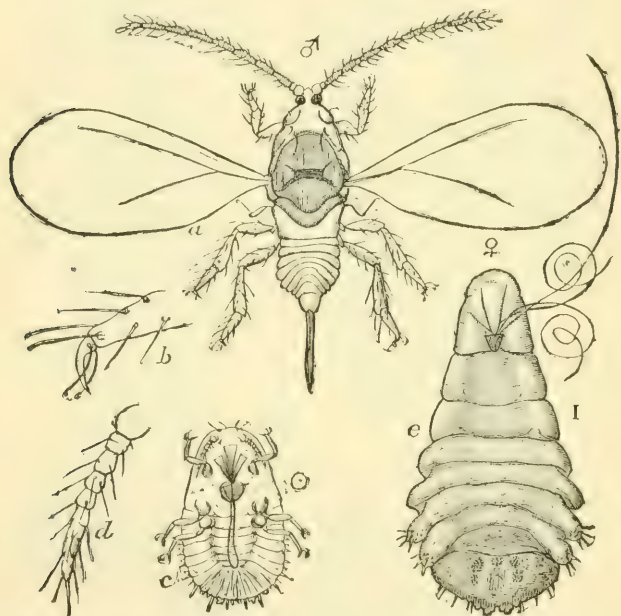


Mytilaspis pomorum: a, adult male; b, foot of same; c, young larva; d, antennæ of same; e, adult female taken from scale;—a, c, e, greatly enlarged; b, d, still more enlarged.



Chionaspis furfurus or Scurfy Bark Louse: a, c, females; b, d, males—a, b, natural size; c, d, enlarged.

quince. As is the case with the preceding species the female scale, if lifted in the winter, will reveal the shriveled body of the insect in front and a mass of eggs behind. The eggs, however, instead of being yellowish in color, as in the Oyster Shell Bark Louse are purplish-red, and number from 10 to 75 in each scale. They hatch about the middle of May. The life-history of this insect is substantially the same as in the foregoing



Chionaspis furfurus: Adult male from above; b, foot; h, tip of antennae of same; c, larva; d, antennae; e, leg of same; f, pupa; g, adult female removed from scale—all enlarged; b, d, e, h, much more than the others.

species. The male insect, however differs quite radically in the character of the scale which it forms. This scale, instead of resembling that of the female in color and general shape, is very much smaller, brilliantly white, rather delicate, having nearly parallel sides and three elevated longitudinal ridges, one on each side and one in the centre. At the anterior end the yellowish-brown

cast skin of the first molt is very evident, its color contrasting so strongly with that of the scale.—L. O. Howard, U. S. Department of Agriculture.

Biology of Bacteria.

By W. D. FROST, M. S.

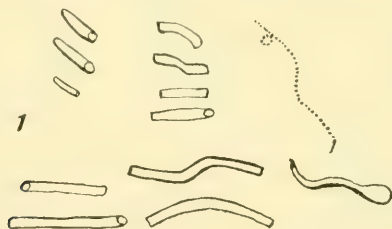
MADISON, WISCONSIN.

DISCOVERY OF BACTERIA.—Bacteria, with which the science of bacteriology deals, are the most minute forms of life; so small indeed that even with the high powers of a compound microscope used in other departments of science they appear as mere specks. On account of their tiny proportions, therefore, it is not strange that for many centuries they were unknown. In fact their presence could not be demonstrated until the microscope had become perfected sufficiently to be able to reveal their presence. This was first done when Anthony van Leeuwenhoek, of Amsterdam, Holland, who had become an adept in polishing lenses, was able to make the first really good microscope. With this microscope he saw in a drop of water what he called little animalcules, but the figures (see Figure 1) and descriptions of them which he sent to the Royal Society of Great Britain in 1767 leave little doubt but that they were bacteria.

BACTERIA ARE PLANTS.—These little forms of life which at first we supposed to be animals, upon further study have been determined to be plants. The lowest forms of life are simply little particles of naked Protoplasm without any protecting membrane, or cell-wall. These are called myxomycetes or slime moulds, and are described and claimed both by the botanists and by the zoologists. Bacteria, while they are smaller, possess a cell-wall which protects the cell contents and gives them a permanent form, so they must be considered as more highly devel-

oped. There is, however, no differentiation in the bacteria into parts, such as root, stem and leaves, as in the higher plants, or even as in the moulds where the portion bearing the productive bodies is different from the growing part of the plant. So while not the lowest forms of life, bacteria are perhaps the lowest forms with a definite outline.

STRUCTURE OF BACTERIA.—Under a high power the individual bacteria are seen to be composed of a colorless, homogenous substance known as protoplasm. The cell wall is not always easy to see but is always present and by means of special reagents can be demonstrated. In some cases it is flexible but is usually quite rigid and has been found to consist not of a single layer but of at least

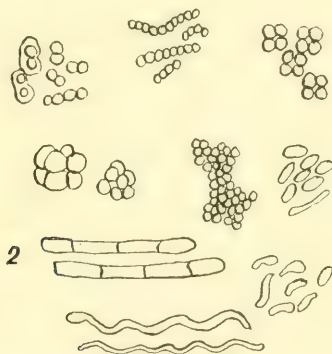


two. The outer one may be more or less mucilaginous in consistency; this often manifests itself as a capsule, as in the case of the organism of croupous pneumonia, see Figure 2, No. 1; in other cases it is indicated by the tendency of the individuals to unite or rather remain attached to their fellows.

THE SIZE OF BACTERIA.—As regards size bacteria are the smallest forms of life known.—The unit of measure employed in microscopy is a micron or 1-1000 of a mm. (about 1-25000 of an inch). Applying this measure we find the dimensions of many of the forms do not exceed a single unit. It is scarcely possible to realize their minuteness. If forms of this size were placed side by side there would be 25,000 to a single linear inch; 625,000,-

000 per square inch and 15,625,000,000,000 per cubic inch. This means that if human beings were no larger than these bacteria we could put the population of the world in a box an inch each way, the population of more than 8,000 similar worlds on top and shut down the cover without being afraid of hitting anyone on the head.

THE FORM OF BACTERIA.—In the above illustration it is presumed that the dimensions of the organism are equal in any and all directions; this is true in one type and such a bacterium is called a micrococcus, or little sphere. The other types are the bacillus, or little rod, and the spiril-



lum, or bent rod, which may take the form of a comma or even of the corkscrew. Between these forms there are many intermediate ones.

THE MANNER OF REPRODUCTION OF BACTERIA.—One of the characters common to all of the different bacteria is their method of reproduction, in fact it is upon this one characteristic that they have all been placed in a single class and called by the botanists schizomycetes, or fission fungi. If a single cell, provided with the necessary conditions of nourishment, is watched under a microscope it will soon be seen that the cell begins to elongate and when this has proceeded some little distance it can be

seen that at about the middle the cell-wall becomes drawn in and soon a new wall is completely formed between the two daughter cells, which in time become full grown bacteria.

THE RAPIDITY OF REPRODUCTION OF BACTERIA.—The rapidity with which the cells may divide and thus reproduce themselves is marvelous; under the best of conditions a single cell will divide once every half hour and it only requires a little work in compound multiplication to show that a single cell under these conditions will produce in twenty-four hours 16,777,220 baby bacteria and at the end of forty-eight hours the number will be 281,500,000,000,000. It is quite needless to say that the proper conditions for this rapid development are not maintained in nature for any length of time or the whole globe would long ago have been completely overrun.

CELL GROUPING OF BACTERIA.—Bacteria may occur singly or in groups and these groups are determined by two factors, the direction in which the cell divides, and the condition of the cell-wall. It will be noticed that bacilli and spirilla always form their new walls in but a single plane and that perpendicular to the long axis, so that these forms may be grouped in but a single way, in the form of threads, varying in length according as the condition of the cell-wall causes the individuals to adhere or allows them to separate. As examples see Figure 2, Nos. 6-9. In the coccus forms the plane of division may take many directions. Where two individuals remain attached they are called diplococci, Figure 2 (No. 1). Arranged in chains (No. 2), they are streptococci. In fours (No. 3) tetrads, while No. 4 represents groups of eight arranged in the form of packets and called sarcina.

CONDITIONS NECESSARY FOR THE GROWTH OF BACTERIA.—Bacteria, in common with the whole class of fungi, require that their carbon should be furnished them in the

form of a compound, such as sugar or proteid, since they have no chlorophyll and are therefore unable to utilize the carbon dioxide of the air as green plants do. Nitrogen is derived from either organic or inorganic compounds, such as proteids or ammonia, except one group (legume bacteria) which is able to employ the nitrogen of the atmosphere. Moisture is essential, for while desiccated bacteria retain their vitality for some time no growth takes place except in the presence of moisture. As regards temperature the range in which growth may take place is very wide and the extremes which prove destructive are still much wider. The lowest point at which growth takes place is about 45° F. and the highest about 110° F., although within a few years there have been isolated forms that grow only at a much higher temperature, 140° F. The most favorable temperature for ordinary forms is from 70°-100° F., the last being the requirement of the disease-producing forms.

If the temperature is congenial and moisture present it is surprising how small an amount of organic matter will support them. It has been found that certain forms cannot only live but can multiply with great rapidity in double distilled water where the only organic matter present is in the particles of dust on the receptacles which thorough washings failed to remove.

THE WIDE DISTRIBUTION OF BACTERIA.—The necessary conditions of growth, solutions of organic nitrogenous substances, are so widely distributed that bacteria are found almost everywhere on the surface of the globe, except in high altitudes, the air of mid-ocean, the deep layers of the soil, and in the circulating fluids of the normal plants and animal body.

RELATION OF BACTERIA TO DISEASE.—While many scientists both before and after Van Leenwenhoek's discovery contended that bacteria were the cause of infectious

diseases, it was not until the researches of Davaine, Pasteur and R. Koch that positive proof was offered. Since that time the etiology(cause) of many of the contagious diseases has been determined and the life history of the organisms so thoroughly studied that the experienced bacteriologists can select them from a number of other kinds with the ease and certainty that a farmer separates the goats from the sheep. And while we do not know what organism causes even some of the most common diseases such as small-pox, rabies and scarlet fever, it simply serves to demonstrate the youth of the science and the vast possibilities before it. And when we remember what has been accomplished in the last two decades we can but stand amazed at the possibilities before us.

There is still much to be desired in our knowledge of infectious diseases and their therapeutics, but there is within our grasp sufficient knowledge of their manner of attack, as that with the proper care most of the diseases can be prevented, and the prevention of a disease is much more desirable than its cure.

THE MODE OF INFECTION BY BACTERIA.—Now that it is definitely settled that the bacteria are the sole cause of infectious diseases, it is interesting to understand their mode of attack. First, they may be inhaled and attack the lungs or respiratory passages, as in the case of pneumonia, tuberculosis and diphtheria. Second, they may enter the stomach with the food or drink and find lodgment in the intestines, e. g., cholera and typhoid fever. The third channel is through wounds, illustrated in the case of rabies and lockjaw. A few organisms like anthrax can enter the system in all of those ways. It finds its way into the body through the lungs in the "wool sorter's disease," through the stomach in cattle, causing splenic fever, by means of cuts in animals and man, the latter causing malignant pustule.

THE MODE OF ACTION OF BACTERIA.—A number of theories have been advanced to explain the way in which the bacteria act on the human system. One of the first theories advanced was that the bacteria deoxidized the blood, inasmuch as some diseases resemble asphyxiation. Another supposed that death was caused by the plugging up of the fine capillaries of the vital organs by the bacteria accumulated in them. Another accounts for the effects by assuming that the bacteria destroy the red blood corpuscles. All of the theories take for granted that the organisms in all cases are found in the blood, but this is not true. In the case of tetanus (lockjaw) and diphtheria the bacteria are localized. To meet these cases, the hypothesis was advanced which is now generally accepted for all cases—namely that the wide constitutional effects are due to poisons manufactured by the bacteria and called toxins—Meyer Brothers' Druggist.

Diagnosing Typhoid Bacilli. Lazarus has made a clinical test of Elsner's method of diagnosing typhoid bacilli. He adds one per cent. of potassium iodide to Holz's acidulated potato-gelatin. Upon this medium the bacterium *coli* develops rapidly, forming at the end of forty-eight hours coarsely granular brown colonies. The typhoid bacillus, on the other hand, grows more slowly; the colonies at the end of forty-eight hours appearing like small, glistening drops of water with very minute granulations.

The stools of five patients with typhoid gave positive results during the first, second and third weeks of the disease. After the subsidence of fever, bacilli were occasionally found, in one case as late as forty-one days after defervescence. Repeated examinations are necessary, as negative results were shown at times to be false by positive findings at a second examination. In one case of typhoid, where remittent fever persisted, the bacilli were found in the stools even up to the ninth week. Negative results were always obtained in patients suffering from non-typhoidal disease of the intestines.—*Medicine*.

THE MICROSCOPE.

New Series, 1893.

For Naturalists, Physicians, and Druggists, and Designed to Popularize Microscopy.

Published monthly. Price \$1.00 per annum. Subscriptions should end with the year. The old series, consisting of 12 volumes (1881-1892), ended with December, 1892. Sets of the old series cannot be furnished. All correspondence, exchanges, and books for notice should be addressed to the Microscopical Publishing Co., Washington, D. C., U. S. A.

CHARLES W. SMILEY, A. M., EDITOR.

EDITORIAL.

A Monument to Pasteur. It has been decided to erect, in one of the principal squares in Paris, a monument to the memory of Pasteur, and that this shall be done by voluntary subscriptions obtained in all civilized nations.

The Paris committee has therefore authorized the organization of a committee for the United States in order to give the people an opportunity to assist in erecting this tribute of appreciation. This committee for the United States is as follows:

Dr. D. E. Salmon, Chairman, Chief of the Bureau of Animal Industry.

Dr. E. A. Schweinitz, Secretary, President of and representing the Chemical Society of Washington, Chief Chemist Biochemic Laboratory.

Dr. G. Brown Goode, Treasurer, Assistant Secretary of the Smithsonian Institution, Dr. George M. Sternberg, Surgeon General, U. S. Army.

Dr. J. Rufus Tryon, Surgeon General U. S. Navy.

Dr. J. Walter Wyman, Surgeon General, U. S. Marine Hospital Service.

Prof. S. F. Emmons, U. S. Geological Survey, representing the Geological Society.

Prof. Lester F. Ward, President of and representing the Anthropological Society of Washington.

Dr. William B. French, Representing the Medical Society of the District of Columbia.

Hon. Gardiner G. Hubbard, President of and representing the National Geographic Society.

Mr. C. L. Marlatt, Assistant Entmologist, U. S. Department of Agriculture, representing the Entomological Society.

Dr. Ch. Wardell Stiles, Zoologist, U. S. Bureau of Animal Industry, representing the Biological Society of Washington.

The members of this committee will be glad to receive and transmit any funds that may be raised. They supply subscription blanks, which when filled will be forwarded to Paris for preservation.

American Microscopical Society.—The nineteenth annual meeting of the American Microscopical Society was held at Pittsburg, on August 18, 19, 20, 1896, under the presidency of A. C. Mercer, of Syracuse. An address of welcome was delivered by Dr. W. J. Holland, chancellor of the Western University. Among the papers read were the following: "Comparative Histology," by Prof. Edith J. Claypole; "Courses in Histology and Methods of Conducting them," by Prof. S. H. Gage, of Ithaca; "Photomicrography by the Use of an Ordinary Objective Practically Considered, with Specimens of Work," by Thomas J. Bray, of Warren, O. "On Astronomical Photographs, with Photomicrographic Apparatus," showing pictures of a partial eclipse of the sun taken on an eight-inch focus, by President Mercer; "The Antivivisection Bill," by Pierre A. Fish, of Chicago; "The Acetylene Lights as Applied to Photomicroscopy," by William H. Walmsley, of Chicago; "What is the Best Method of Teaching Micro-Science in Medical Schools?" by Dr. Vida A. Latham, of Chicago; "The Structure of the Teeth and Spines of Some Fossil Fishes, *Mazada* and *Ctena Canthus*," by Prof. E. W. Claypole, of Akron, O.; "The Development of the

Brain in Soft-Shell Turtles," by Susanna Phelps Gage, of Ithaca, N. Y.; "The Rotifera in Sandusky Bay, by Prof. E. W. Claypole, of Akron, and D. S. Kellicott, of Columbus, O.; "On the Public Water Supply for Small Towns," by Dr. M. A. Veeder, of Lyons, N. Y.; "The Requisites of a Pure Water Supply," by Dr. William C. Krauss, of Buffalo, N. Y.

PRACTICAL SUGGESTIONS.

BY L. A. WILSON,

CLEVELAND, OHIO.

The Detection of Adulterations in Food.—A microscopist may accomplish a large amount of useful and practical work by examining and demonstrating adulterations in foods, drugs and commercial articles.

A substance will exhibit under the microscope particular appearances. A stranger introduced will at once be recognized. That one may know that a stranger is a foreigner, the first requisite is to know exactly the appearance of the pure article. To obtain this knowledge requires time, patience and perseverance. Having become familiar with the pure article it is very easy to detect the adulterations. It is practically impossible to deceive the microscope when its revelations are interpreted by an expert eye.

Keep the Eye Pieces Clean.—Once upon a time a dealer with a large invoice of nice bright golden microscopes descended upon a town.

He found an interested prospective purchaser. To exhibit a lens he placed a drop of his blood upon a slide, focussed and looked down the tube, when horror to relate he beheld every corpuscle teeming with bacteria. Cold perspiration streamed down his brows and cold chills coursed up and down his anatomy; when a veteran microscopist present took a look, turned the eye piece and discovered that the alleged bacteria were minute spots of dust upon the lower lens of the eye piece. This is a fre-

quent mistake. To avoid it clean the eye piece by breathing upon it and wiping off gently with a soft clean handkerchief.

Mounting Polycystina.—These shells may be mounted as transparent objects in balsam. In the latter medium they do not show to best advantage; neither are they perfect when mounted dry without preparation as they present too glassy an appearance. For perfect results heat them on platinum foil, mica or some other support by means of a blow-pipe flame or over a lamp. This heating will destroy the glassy appearance and render them opalescent. Then mount them as opaque objects and a beautiful slide will result.

SCIENCE-GOSSIP.

Baltimore Inspects its Bakeries.—The Board of Health of Baltimore has appointed an inspector of bakeries, whose duty will be to make periodical visits to such places, and inspect material, utensils, and everything pertaining to the operation of baking. The aim of the department is a worthy one, and conducted upon lines sufficiently wide, should correct the typical unsanitary surroundings of such places, and insure cleanliness among those upon whom the care or carelessness of whose persons and their surroundings depends, in a great measure, the public health. —*American Medico-Surgical Bulletin.*

Flash-light Paper.—Flash-light paper, a dangerless convenience for photographic purposes, is prepared (Papier Zeitung) by coating one side of two sheets of calendered paper with starch or flour paste, then sprinkling upon the paste powdered magnesium, and pressing together, to cause them to adhere. After drying, a sheet similarly covered with powdered potassium chlorate is pasted upon each side, so that the powdered magnesium contained between the first sheets has a layer of potassium chlorate on each side. A further sheet pasted on serves as a covering, and the whole, which forms a thick sheet, can be cut into strips.

THE MICROSCOPE

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Ripans Tabules.
 Ripans Tabules cure nausea.
 Ripans Tabules: at druggists.
 Ripans Tabules cure dizziness.
 Ripans Tabules cure headache.
 Ripans Tabules cure flatulence.
 Ripans Tabules cure dyspepsia.
 Ripans Tabules assist digestion.
 Ripans Tabules cure bad breath.
 Ripans Tabules cure biliousness.
 Ripans Tabules: one gives relief.
 Ripans Tabules cure indigestion.
 Ripans Tabules cure torpid liver.
 Ripans Tabules: gentle cathartic.
 Ripans Tabules cure constipation.
 Ripans Tabules: for sour stomach.
 Ripans Tabules: pleasant laxative.
 Ripans Tabules cure liver troubles.

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OCTOBER, 1896.

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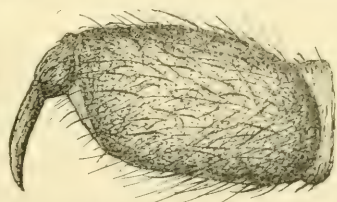
NEW SERIES

Objects Seen Under the Microscope.

By CHRYSANTHEMUM.

XXXV.—THE FANG OF THE SPIDER.

The spider (*Clubiona atrox*) that we find in our out houses, is an interesting object for study. It has long legs, moves very swiftly and builds a compact cloth-like web with a gallery open at each end for retreat in time of danger. Near such a web may sometimes be found a cast off skin. This is very suitable for examination under the microscope as every part; the fangs, the palpi, the legs with all their joints, the eyes, the antennae, every hair,—all with a clear-parency which requires much skill to obtain, if a living spider were captured for the purpose.



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There are in front of the head two stout brown organs, which are the representatives of the antennae in insects, though very much modified both in form and function, being used by the spider as weapons of attack. They are composed of two joints, the basal one is the most conspicuous and consists of a thick hollow case of stiff chitine, somewhat cylindrical, but flattened sidewise. Its whole surface is covered with minute transverse ridges, and studded with stout coarse black hairs. Its extremity is cut off obliquely, and forms a furrow, the edges of

which are beset with polished conical points resembling teeth.

To the upper end of this furrowed case is fixed by a hinge-joint the fang, which is a curved claw-like organ, formed of hard chitine, and consisting of two parts,—a swollen oval base, which is highly polished, and a more slender tip, the surface of which has a silky lustre, from being covered with very fine and close set longitudinal grooves. This whole organ falls into the furrow of the basal joint, when not in use, exactly as the blade of a clasp-knife shuts into the haft; but when the animal is excited the fang becomes stiffly erected.

By examining the tip of the fang we see that it is not brought to a fine point, but that it has the appearance of having been cut off slantwise just at the tip; and that it is tubular, both the fang and the thick basal joint are permeated by a slender membranous tube, which is the poison duct. This connects with a lengthened oval sac where the venom is secreted.

When the spider attacks a fly, it plunges into its victim the two fangs. These act downward, not from right to left as do the jaws of insects. At the same time a very small drop of poison is secreted in each gland, which, oozing through the duct escapes from the perforated end of the fang into the wound, and rapidly produces death. The fangs are then clasped downward, carrying the prey, which they powerfully press against the toothed edges of the stout basal piece. By this means the nutritive fluids of the prey are pressed out and taken into the mouth, when the dried and empty skin is rejected. This poison is of an acid nature, as litmus-paper, when pierced by an irritated spider, is turned red as far around the perforations as the liquid spreads.

A Post Graduate course of bacteriology has been established at the Sidney University, N. S. W.

Primary Bacteriology.

Amateur bacteriologists complain that notwithstanding they have a good microscope and accesories, they have no ovens, culture tubes, petri dishes, and a great deal of apparatus which is listed in almost all of the catalogues, which they cannot afford to buy. Of course I admit that a well-equipped laboratory, which will probably in this state be found only in our leading medical colleges, is of great advantage and far more convenient ; but he who wants to study can improvise the necessary apparatus to start his first investigations and hope that by the time he is ready to continue his research he will have fallen heir to wealth.

Let us talk of the preliminary work a little : We have a microscope but only have a one-fifth inch objective ; we have been told that without a one-twelfth inch oil immersion lens and an Abbe condenser it would be fruitless to search for bacteria, and on account of the expense these valuable accessories have not been added. Some micro-organisms can be readily seen with a much lower power than a one-twelfth inch objective, as for instance the subject of urine which we now propose to take up.

Procure a bottle of your own or some patient's urine, allow to stand open in a warm room 36 hours, and from the surface, with pipette, take up a small drop of scum, as it appears without cover glass, place on an ordinary slip and examine with a fourth or fifth-inch lens, and many forms of living organisms will appear. I have seen every variety plainly and distinctly except the spirilla, and, of course, the flagella can not be discerned under such a low power. Their movements must not be mistaken, for the rapid evaporation causes currents, and, in fact, sometimes so rapidly do they move from under the field that it is impossible to follow them.

Now, having watched their movements carefully and

made a note of their size, shape and general characteristics, let us proceed further with the same slip, which we find by this time quite dry except in its center, and like the fish lying in the pond after the water has evaporated, we still have our beauties but they are dead.

Take a small drop of gentian and place in center of slip. You will readily note on examination that the rods will appear much plainer than before, but are thicker and shorter. The coloring matter has formed a layer upon them, and hence the apparent enlargement. The micrococci, staphylococci, streptococci, diplococci and sometimes sarcinae, should not be overlooked. The Brownian movement should not be mistaken for the organisms surviving under the treatment of our straining process. Now, prepare another slip in similar way and stain with alkaline methyl blue, and you may be able to discern in some single bacillus a deeper color at the ends, or, possibly, a much lighter stripe in its middle than either body or ends.

Now, let us examine in the same manner a drop from a lower strata and see what we will be rewarded with, and for convenience, and a more prolonged study, with a camel's hair pencil and melted paraffine we will make a little ring on one slip just the size of our cover-glass. Put the drop of urine in the shallow cell thus prepared, drop on cover-glass and seal with paraffine, and if we are patient enough we can see in this hermetically sealed cell the cell division taking place in this flowerless plant called bacteria, and, under proper conditions, the growth would be quite noticeable within 24 hours. Of course the younger plant looks smaller than its mother plant, hence when the parent cell is ready to divide, it is no surprise to us to notice the difference in size. By using aniline stains of different strengths a great deal of information may be gleaned, and by mak-

ing cover-glass preparations something more learned.—
Langsdale's Lancet.

The Physician and his Microscope.

BY A. A. YOUNG M. D., NEWARK, N. Y.

One of the most expensive and one of the most useless pieces of office furniture that the ordinary physician possesses is his microscope. It usually occupies a most commanding and conspicuous place in the office and decorated with "fuss and feathers"; valueless as an educator, valuable for the macroscopical appearances of the microscope, for it is capable of producing wonder and awe to the office visitor and shekels to the pocket of the physician.

Nothing can be said against the microscope as an instrument, for its value resides in its intelligent use, and unless used intelligently it becomes worse than useless, distorting facts and fancies alike, from which the observer can form no concept, can draw no conclusion save an erroneous one. The physician has to deal with the organic world, with those material forms in which resides that peculiar, unresolvable and unknowable agent we call life, and without which matter becomes comparatively valueless.

The microscope in the department of medicine requires for its intelligent manipulation a familiarity with anatomy, pathology, bacteriology, and last, but not least, biology, which subject scarcely ever enters into a medical college curriculum. We, as physicians, must deal with material forms that are endowed with life, and of that relation which exists between the material form and life we must have some concept, though it be partial and inadequate; for on the relation of things material or

*Read at the nineteenth annual meeting of the American Monthly Microscopical Society, Pittsburgh, Pa., August 19, 1896.

immaterial is the development of human thought possible. The life force of the bacillus is doubtless as intricate as the life force of the human subject and may be similar if not identical with it; for what is the body in which the ego resides more than an aggregation of ameba specialized, and each ameba possibly having an independent life and having reproductive properties of its own. It is with the minute mass of matter, not the molecule, that the microscopist has to deal; he sees its manner and method of growth and not the forces which produce the molecular arrangement of the ultimate particles.

It is not enough that the physician be able to observe and differentiate the various forms of the micrococcus, spirillum or bacillus: he must know as well the habitat, manner and method of growth of each variety. Without this knowledge the revelations of the microscope are no more intelligible than some Egyptian inscriptions. There is a philosophy of microscopy which is equally as valuable as the facts on which it is based, but a philosophy that can only be developed by accurate observation and classification of microscopical data. This work, it is evident, must be performed by the skilled microscopist and not by the novice, in which class the busy practitioner is usually found. In microscopical analysis no element relative to accuracy can with safety be omitted. It matters not though the microscopical accessories be thoroughly cleansed and sterilized, for the results would be equally untrustworthy if the material to be examined be placed in a receptacle, found perhaps in some old garret and half cleansed. Conclusions reached under such conditions must be erroneous. Do you ask who ever allows such procedures? Go to the home of the amateur or pseudo-microscopist, observe his methods and technique and you will have the answer. It is surprising how much we see, how much we assume and how little we

know. A young physician asks an old one for the use of his microscope to examine a specimen of urine, assuring its owner that he is familiar with the instrument, having had instruction in college; permission granted, and slide prepared, and the observer exclaims, "The most beautiful specimen of a cast I have ever seen;" the owner of the instrument says, "That looks like vegetable matter and not a cast." "No," said the other, "that is a urinary cast; I have seen many of them." A microscopical examination of the container and its contents revealed a corn-cob for a cork; what the cast was you may readily infer.

A physician of several years' standing and the possessor of a good microscope at an autopsy of his announced that the patient's death was due to a disease of the kidneys, that she had been passing blood, pus, all forms of casts and other bad material with the urine. The autopsy, however, revealed ulceration with pus formation, degeneration and rupture of the gall-bladder, produced by impacted gall-stones, while the kidneys were practically normal, showing no structural degeneration. From whence, then, came the blood, pus, casts and debris, which was alleged to have been seen? These cases could have been none other than of mistaken identity; something was inferred that did not exist.

The conclusion is therefore reached, justly or otherwise, that the eye and understanding must be educated independently along certain lines before the manipulation of the microscope becomes satisfactory and trustworthy; objects must be seen and known relatively and in their entirety before being resolved into their component elements; the macroscopical appearance of an object must precede its microscopical appearance.

The physician must know in what menstruum and under what conditions the objects for which he is searching exists or are developed. Neither is it enough for him

to know and recognize the various forms of bacilli; he must be able to classify them and know their manner and method of growth, what they produce by their growth and what influence they have upon humanity. This is the philosophy of microscopy as relates to medical science. The microscope therefore becomes to the physician valuable in the degree that he is able to classify and arrange its revelations so that they may be read as from an open book. This faculty means a familiarity with the instrument born of time,—time which the “country doctor” must give by piecemeal, if at all.

I am no pessimist, although I see in a degree the passing of the microscope so far as it relates to the individual work of the ordinary medical practitioner. As already intimated, this passing is induced and sustained by unskilled and untrained eyes, which see much and individualize little.

The structure of microscopy, if it be enduring, must be built upon a comparatively errorless microscopy. The rank and file still have to learn that the microscope only enables the investigator to continue his eyesight, so as to observe the primary structure of an organised mass that would otherwise remain unknown and unknowable.

The first essential, then, for a physician microscopist, is the proper use of his eyes, supplemented by a keen intellect; what he sees he must be able to describe accurately, thus differentiating the various forms and figures that appear in the visual field.

Neither is it enough for him to recognize an object in an isolated condition and know its form and construction: he must know as well what relation it sustains to other objects about it. This calls for the exercise of the comparative faculty, the second essential for the physician microscopist; indeed, these two elements may be called his eyes. With these faculties undeveloped, untrained,

he may as well be a blind microscopist. What is true of normal vision is preëminently true of aided vision, which aid the microscopist, but it produces changes also in the relative conditions of objects, and of such changes the mind must take cognizance; it is an element too often overlooked. In short, the revelations of the microscope becomes the alphabet and the systematic arrangement of these revelations in the human mind forms its language, a language that requires study to comprehend; a language also that needs much further development and amplification. Physicians, as a rule, can be novices only in microscopical science, following where others lead; they stand at your feet, at the feet of the microscopists of the world, in the relation of pupil to teacher, asking for more light to illuminate the intricacies of human existence.

Give to them this light; save for them the microscope with all of its powers and possibilities which are vast; prevent it by your efforts from relapsing into a state of "innocuous disuetude."

PRACTICAL SUGGESTIONS.

BY L. A. WILSON,

CLEVELAND, OHIO.

The Hepaticae.—These plants are the liverworts or liver moses. They may be found abundantly on the ground, on rotten wood, on stones, near water falls and on moist rocks. The eye easily distinguishes most of them from true mosses. They require the microscope and generally low powers for their investigation. They are beautiful and interesting; when gathered they may be kept in boxes and when examined in a drop of water always look green and fresh and in the dead of winter remind us of the woods and fields. They are analyzed chiefly by their leaves which furnish an almost endless variety. To ex-

amine cut off a sprig about one half of an inch long, place on a glass slip in a drop of water, cover and then see that the cover is completely filled with water. An inch objective is all that will usually be required. It frequently requires sharp eyes to observe the under leaves which frequently aid in the determination of species.

An Improvised Erector.—For dissecting or manipulating under the microscope it is necessary to erect the image, at least, in order to work with comfort or precision. A cheap erector may be quickly improvised by fitting a right angled prism over the eye piece with the widest face from the observer.

Logwood Staining.—To bring out details of structure and display cell walls, etc., there is no better stain than logwood, and for singly stained vegetable sections it is to be recommended in preference to all other staining fluids. A logwood violet fluid is prepared as follows:

1. Haematoxylin 20 grains
Absolute Alcohol 1-2 ounce

2. Solution of 2 grains of alum to one ounce of water.

To stain proceed as follows:

First:—Remove the sections from alcohol to water for a few minutes.

Second:—To alum solution for ten minutes.

Third:—Stain in No. 1. .

Fourth:—Place in alum water to remove stain from surface.

Fifth:—Wash thoroughly in water.

Sixth:—Place in alcohol for two or more hours. Float the section lightly on the surface of oil of cloves—when it sinks it is ready to be mounted in balsam.

A Comparison of Lenses.—A novice recently purchased a lens from an itinerant agent of a foreign manufacturer. With the lens he also purchased a slide of *Pleurosigma angulatum*. Upon the grand resolution of this slide the novice based his opinion of his new lens.

Full of faith and confidence he carried his lens and slide

to a friend. The novice displayed his acquisition. The friend exhibited a balsam mount of the same frustule under a fine Spencer 1-6 objective. The Spencer resolution seemed to be cast entirely in the shade. It developed, however, that the diatom under the foreign lens was mounted in naphthaline monobromide. When the balsam mount was placed under the foreign lens the Spencer lens resumed its well-deserved gigantic proportions. Moral: A novice should never purchase a fine lens without the advice and inspection of an expert.

QUESTIONS ANSWERED.

NOTE.—Dr. S. G. Shanks, of Albany, N. Y., kindly consents to receive all sorts of questions relating to microscopy, whether asked by professionals or amateurs. Persons of all grades of experience, from the beginner upward, are welcome to the benefits of this department. The questions are numbered for future reference.

Q. 243.—Where may be obtained the substance "Gum Thus"? F. F. E.

A. An order placed with Wm. Schieffelin & Co., Druggists, New York, will probably bring Gum Thus.

Q. 244.—What is the name of the best book giving methods of staining, especially double staining for both plant and animal specimens? F. F. E.

A. The methods of Microscopical Research by Arthur C. Cole, or Practical Methods in Microscopy by C. H. Clark, will be found useful.

SCIENCE-GOSSIP.

The Poultice a Hot Bed of Bacteria.—Dr. J. C. Biddle, in the Lehigh Valley Medical Magazine, calls attention to the abuse of poultices, and says he has seen many cases, where the application of a poultice has done irreparable damage. He has seen many cases where poultices were applied to abrasions, contusions, sprains, simple and compound fractures, until the skin and underlying tissues

were water-soaked. "Should this be done," he asks, "without our present advanced knowledge of medicine and surgery?" Most certainly not. The ordinary poultice has no longer a place among the resources of the aseptic surgeon or the practitioner who has any knowledge of bacteriology.

The poultice is a hot-bed for bacteria, and, such being the case, should not be used, especially where the circulation or tissues have been destroyed, as in an injury of any kind. For this reason I teach that we should cease applying the culture medium of the streptococci and their congeners. As a general rule uninjured epidermis is impervious to organisms, but when we soften it, as with a poultice, we open the sweat ducts and give the micro-organisms easy access to the tissues beneath.

Syphilis from a Flea Bite.—Jonathan Hutchinson reports a primary lesion of syphilis of unusual origin. An elderly member of the profession presented himself, covered with an evidently syphilitic eruption, which rapidly disappeared under the use of the mercury. A careful examination of his entire surface revealed no trace of lesion whatever on the genitals or at any point, except a dusky spot on one leg, which looked like the remains of a boil. This, the doctor stated had been due to a small sore, the dates of the appearance and duration of which were found to fit exactly with those of a primary lesion. There had also been some enlargement of the femoral glands. He had never thought of the sore in this connection, but remembered most distinctly that it followed a flea-bite in an omnibus. Mr. Hutchinson concludes that all the evidence tends to show that the disease had probably been communicated from the blood of an infected person through the bite of the insect.—*Medical News*.

A Rapid Method of Affixing Paraffin Sections on the Slide.—A small drop of Mayer's albumin mixture is placed in the middle of a slide, and the section, from the microtome knife, laid on this drop. The drop forms a cushion and partially flattens the section. A piece of thin, smooth

writing paper is then coated with albolene (liquid vaseline), and the oily slide laid directly down on the section. With the ball of the thumb or finger firm pressure is made on the paper over the section; upon removing the paper the section will be found perfectly flat and firmly adherent to the slide. The slide is gently heated over a flame until the paraffin melts, and then it is placed in a jar of benzine or xylol to dissolve off the paraffin, when, after treatment with 95 per cent. alcohol, it is ready to be stained in any way desired. The albumin is forced away from the immediate neighborhood of the section by the combined action of the pressure and melting of the paraffin. The pressure should be made *directly down* on the section, and may be exerted to any degree without injury to the most delicate section, if the thumb is not allowed to slip or twist. Care must be taken not to *rub* the paper as it lies upon the section, for in this way the section is often made to stick to the paper.

It will be seen that this method is very rapid as well as very simple; its results are all that can be desired in routine work, and it can be very readily grasped by the laboratory student.—Med. News.

Microtomes.—The attention of the Biological section of the British Association was drawn to the construction of microtomes by a communication from Prof. C. S. Minot, of the Harvard Medical School, Cambridge, Mass. In recent years there has been a growing and justified demand for microtomes to make good sections of great thinness, if possible, not over one five-hundredth of a millimetre or 2 microns (0.002mm.) In the automatic microtome, worked by a revolving wheel, devised by Prof. Minot, which was now made in England, Germany, and France, as well as in America, the attempt is made to secure mechanical perfection, and so far successfully, that sections of 1-300mm. may be made with it. This microtome is, however, adapted only to cutting objects imbedded in paraffin.—Eng. Mechanic.

Tobacco and Cholera.—A recently published report of

investigations of the effects of tobacco during the epidemic of cholera at Hamburg states that there were no live microbes after twenty-four hours in the cigars made up with water containing 1,500,000 cholera microbes to the cubic centimeter. There were no traces of microbes to be found in any of the cigars manufactured at Hamburg during the course of the epidemic. The microbes die in half to two hour's exposure to tobacco smoke, Brazil, Sumatra or Havana tobacco. The smoke of any cigar kills the microbes. The smoke kills in five minutes all the microbes in the saliva. Another fact established is that none of the persons employed in the tobacco factories at Hamburg, contracted cholera.—*Gaz. degli Osp. e delle Clin.*

Typhoid Fever Caused by Ice Cream.—According to the Boston Medical and Surgical Journal, August 27, a considerable, but not widely extended, outbreak of typhoid fever occurred during the latter part of July in the town of East Barrington, N. H. The cases were all traced to a single source. The first case was an unrecognized one, the patient being unwell but helping about the house and doing part of the milking. It is supposed that he must have in some way contaminated the milk, as by going to stool and not washing his hands before returning to his milking. The water supply was carefully examined and found to be all right. On Friday evening a party was given at the house and the guests were given ice cream made at home from the milk supply above referred to. Within the next ten or fourteen days fourteen of the guests came down with typhoid fever—eight in the town of Barrington, of whom one died; two in Lee; one each in Dover, Rochester and Woodbury, N. H., and one in Haverhill, Mass. All of these out-of-town cases were guests at the party. No other cases occurred in the town, and all were partakers of the cream.

ZEISS MICROSCOPES are joys forever, and would doubtless have been in much greater demand were it not that a stand with coarse adjustment by rack and pinion could not until recently be obtained for less than £7 10s. A smaller

stand, however, is now supplied for £5 5s., and this when properly equipped with the necessary lenses will serve every purpose for students and even practicing pharmacists. It has a fixed stage, 80 mm. square, rack and pinion coarse adjustment, and micrometer screw fine adjustment. The stand inclines, and the tube when fully extended measures 160 mm. long. Fitted with Zeiss achromatic objectives, A and D; Huyghenian oculars, No. 2 and 4, and a suitable condenser, the instrument is sufficiently complete for a student's use, whilst the further addition of a 1-12 inch oil immersion objective would make it suitable for all-round work in the pharmacy.

WATSON AND SONS, London, list a number of useful novelties in micro-apparatus, including "parachromatic" objectives, wherein a fair ratio of aperture to power is maintained for a moderate price; an excellent "parachromatic" condenser, N. A. 10, costing but little more than the ordinary achromatic condenser; and an improved Abbe model camera lucida in aluminium, the advantage gained by the use of this light metal being considerable. The Edinburgh Student's Microscope is now supplied in almost all conceivable styles, and should specially recommend itself to pharmacists.

Impure Water in Indiana.—In Johnson county, Indiana, there is a village known as Rock Lane. Connected with the Rock Lane Church is a well from which a large proportion of the people of the neighborhood drink. Over seventy-five per cent of these people have during the past year suffered with typhoid. The water of this well has been examined and found to be infected badly with intestinal bacteria. Even a chemical analysis showed a bad condition of affairs. It was along time before any one discovered that all the people taken ill were attendants at the church and that the non-church going people were immune.

Professor A. N. Prentiss, formerly professor of Botany at Cornell University died at his home in Ithaca, Aug. 14.

THE MICROSCOPE

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THE MICROSCOPE

NOVEMBER, 1896.

NUMBER 47

NEW SERIES

Objects Seen Under the Microscope.

By CHRYSANTHEMUM.

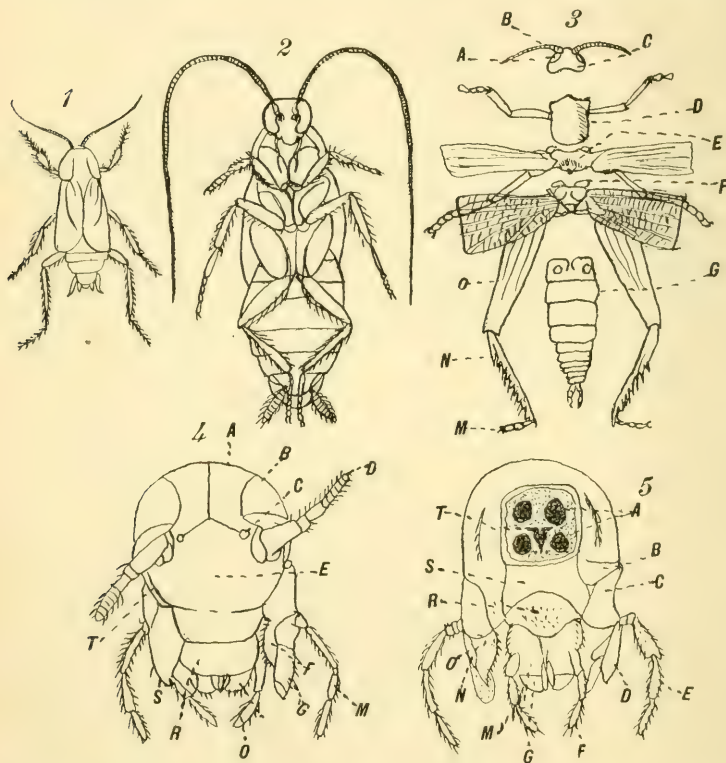
XXXV.—THE COCKROACH.

The scientific name of the common kitchen blackbeetle is *Periplaneta orientalis*; *periplaneta* meaning to wander, *orientalis* because of its coming from the east. The cockroach found on ships is *Periplaneta americana* and it is this that we will study it being larger than the other although they are very similar in structure. They are nocturnal in their habits, love warmth and shun the light. They are easily killed for study by chloroform.

STRUCTURE.—The elongated body is flattened from upper to under surface, and is roughly oval in cross-section. It presents three regions (figs. 1 and 2). Fig. 3 represents the general plan of the typical insect body. The head (fig. 3 c.), carrying the jaws and sense organs; the abdomen (g), within which are the most part of the digestive, circulatory, respiratory, secretory, nervous and reproductive organs. The head apparently of only one segment, is really of six segments fused together. The thorax is of three segments; the prothorax (fig. 3, d); mesothorax (e); metathorax (f). This external segmentation is only repeated internally in the muscles and the nervous system.

The exterior body is hardened into sclerites. These are cuticular and chitinous, and are thicker, harder and darker brown over the body generally than they are at the joints where the integument is softer and more pale.

The head is lent backward or reflected, and bent downward or deflected so that it cannot readily be seen from above and what looks like the front of the body from above is really the dorsal part (pronotum) of the first thoracic somite, prothorax (fig. 1). Fig. 2 shows the under or ventral, aspect of the body with the head de-



flected under the ventral side of the body, and its anterior portion actually looking backwards.

The various sclerites that make up the hard part of the head are shown in figures 4 and 5. Fig. 4 represents the head of the ship cockroach as seen from the front; fig. 5, as seen from the back. Both are copied from Marshall and Hurst's work.

The epicranium (a) covers the dorsal and posterior region of the head. It has a median suture or seam (fig. 4) that divides anteriorly into two, running out, right and left, to pale oval patches, the fenestræ, meaning windows, the clypeus (fig. 4 e) meaning a shield. The genæ (fig. 4 t) cover the sides. The left gena has been removed in the figure.

Between the head and the thorax is a constriction, the neck, on which are seven sclerites.

The prothorax is not rigidly articulated onto the mesothorax and its pronotum is longer than either the mesonotum (dorsal aspect of the mesothorax (fig. 3 e), or the metanotum (dorsal aspect of the metathorax (f). The abdomen (fig. 3 g) is of ten somites. The full number cannot always be counted. When the cockroach is looked at from without, some of the somites slip under and over one another like the joints of a telescope. The abdomen is broad from side to side, flattened from above downwards.

The food of the cockroaches is mixed. They can eat pretty much everything but they prefer dead animal matter. They eat their own cast off skins and egg capsules. They do not eat a great deal and grow but slowly. One of them has been known to live as long as five years.

The parts surrounding the mouth may be seen after fixing the cockroach on its back by pins passing through the sides of the pronotum. Bend the head from its reflexed and deflexed position forwards and upwards, and fix it by crossed pins.

The lips are seen to be two; an upper, the labrum, (fig. 4 r), and the lower, the labium (fig. 5 r, s). The labrum is articulated on the front edge of the clypeus (fig. 4 e) which represents the front view of the head. The labium is made up of two parts, the mentum (fig. 5 r) and the sub-mentum (fig. 5 s) which represents the back view of the head, mentum, the chin. The labium has also certain

extensions or feelers, the labial palpi (fig. 5 f), which have each three joints.

To see the jaws, remove the labrum (fig. 4 r), and also, as has been done in this figure, the gena and mandible (fig. 4 t, s). All parts thus removed from around the mouth should be mounted in glycerine, and examined under low powers of the microscope.

The jaws consist of three pairs,—one pair of mandibles (fig. 4 s), and two pairs of maxillæ. In figure 4 the left of the first maxilla is well shown to the reader's right, and some of its divisions are lettered f. g. m. In figure 5 the left first maxilla also is shown and some of its divisions are lettered b. c. e. The second pair of maxillæ are both shown in figure 4 and the left one is marked n. All these six jaws are biting ones.

The mandibles (s) lie below the genæ (t) and are articulated to the epicranium (fig. 4 a) and clypeus (fig. 4 e). They are strong and toothed.

The first maxillæ present a subdivision of the appendages of the body that run through the whole of the classes of the Arthropoda or jointed footed animals. A basal part, the protopodite, and two parts attached to the distal end of this, one nearer the middle line of the animal's body (the endopodite) the other farther away from it (the exopodite). In the maxilla of the cockroach, protopodite consists of two joints, called respectively the cardo, (fig. 5 b) and stipes (fig. 5 c),—cardo, a hinge; stipes, a log. The endopodite is of two parts, the lacinia (fig. 4 f) on the inner side, the galea (fig. 4 g) on the outer side. Lacinia means a lappet; galea, a helmet. The exopodite is the maxillary palpus (figs. 4 m, and 5 e) with two short basal joints and three longer terminal joints.

The protodites of the second pair of maxillæ are fused together in the labium with its mentum (fig. 5 r), and submentum (fig. 5 s) already described. The endopodites

are also fused together into the ligula (fig. 5 m) and the paraglossa (fig. 5 g). The expodites are not fused and constitute the labial palpi (figs. 4 o and 5 f).

We are indebted for the facts in this article to E. Aveling's contribution in the *English Mechanic*.

(*To be continued.*)

What Can a Boy do with a Microscope?

By E. E. MASTERMAN.

NEW LONDON, OHIO.

Having made an effort to encourage microscopy among the boys and girls, I feel, in a measure, that I should write you something in favor of it.

I have had many questions confront me, among which I choose two, viz:—"What can they accomplish with a microscope?" and "What sort of a microscope do they use?"

To the first I could give a great many answers; upon the second always has depended, in my observation, the sum of money at the boy's command and the encouragement he received from others. Though speaking of boys, I have known girls to do equally as well. Those coming under my observation have ranged from 12 to 20 years of age.

The primary object I always have had in view has been to encourage investigation, that they may know something of the beautiful around them and possibly make a portion of them professionals. All professionals were boys and girls once, and little encouragement did some of them receive.

I am inclined to believe that one of the reasons why so few boys and girls take to scientific investigation is because of the lack of encouragement from those who are older.

Now, the first question, "What can they accomplish with the microscope?"

That depends on the boy, his teacher (if he has any), his ability, his love for the study, his encouragement, his finances, and other things.

Among the finest slides I ever saw were those made by a boy of 16 years. Did he become a professional microscopist? No, not at all, but the spirit of investigation was aroused in him to such an extent that he graduated at Baldwin University, post-graduated at Princeton with a degree of Sc. D., and now occupies the chair of Physics in the polytechnic department of Case School of Applied Science. The world knows his experiments with the Roentgen or X-ray—Dr. D. C. Miller, A. M., Sc. D.

This is perhaps one of the brightest examples I might give, but others are doing surprising work, and are getting an insight into nature.

One lad of 13 of my acquaintance made a fine beginning with pollen mounted and dried in balsam. Another began by making sections of stems and piths of plants. The two worked together and obtained a knowledge of structural botany that probably they never would have obtained otherwise. They also examined the sap of different plants, obtaining some surprising results by evaporation. Many slides were spoiled, of course, but who is or could be perfect from the beginning.

Another boy mounted spores of ferns, etc. and also made slides of wings of insects, and with such a book to study as was at his command he received a training in comparative entomology which has proven useful to him.

Making slides is but a small part of the work. I encourage laying more stress on making drawings of everything, if possible, with the aid of a camera lucida.

One fellow began by studying parasites injurious to the horticulturists. At home he was met with opposition, but when his studying led to the partial destruction of the pests and a partial crop of berries

while the neighbors had no fruit, then, and not till then, did his father praise or encourage him.

“What sort of a microscope do they use?”

That depends on the cash at hand. I always recommend if one has a certain sum for such purposes, that four-fifths of the money be set aside for the microscope, the remaining one fifth for things necessary that cannot be made,—balsam, zinc white, chloroform, etc.

If two or three can agree to put their money together and get a microscope, thereby getting a better one, they are the gainers by it in many ways.

They should also have a book of instructions. Manipulation of a Microscope, by E. Bausch, is a good one, and there are many others. In a paper of this kind I recommend no manufacturer, all having good instruments. A book for notes should be had, and as for the material, the world is full of it.

Were a person to make a boy of 12 to 18 years a present of \$25.00 I would suggest that it be applied on a microscope and necessary articles that must be purchased. Some good cannot but be the result.

So, I repeat, encourage this line of study among the boys and girls that they may see more of the world about them from the commoner and coarser things to the higher and refined.

Collecting Fungi.

E. E. MASTERMAN,

NEW LONDON, OHIO.

In this locality (north-central Ohio) the year 1896 has been a very excellent one for the growth of fungi. They are to be found on the leaves, stems, and branches of plants. Taking advantage of suitable opportunities I collected as many as possible and in the same way that any botanist would accumulate his treasures. I pre-

pared them in very much the same manner. It is best to cut away the thick veins, ribs, stems, and portions of the leaves or plants that are useless or not affected. When small save all of the leaf, stem, plant, &c.

I place my specimens between very porous white blotting paper, and do not subject them to any degree of pressure for fear of injuring the fungi. I air them every day. I think this is necessary. Some leaves upon which the fungi grow need this oftener than daily.

When perfectly dry I place them in any tight envelope of proper size that fits the specimen and keep these in a tight box. When needed for study or comparison, I use the specimens as any ordinary opaque object.

Should one label them, which I think necessary, the date, locality, and collector's name should accompany the specimen. I write on my labels the name of the plant exactly as a botanist would, in fact I first label the plant botanically, then write the name of the fungus.

In collecting it is well to "git a plenty when you are a-gittin'," for you may wish duplicates to exchange. I think it well to deposit samples of each in some permanent institution, such as Experiment Stations, Universities, Colleges, &c., where they can be had for future reference and study. This course may also bring yourself before the learned to some extent and the acquaintance of one or more of these people is well worth the trouble of collecting and preparing a few specimens. Corresponding acquaintance is worth much to a student. Many new hints and helps may be gained while you may help some one else more than you realize.

Diphtheria is prevailing to an unusual degree in London, the mortality from the disease during the first week in October having been greater than that of any week this year.

Practical Hints for the Worker.

By B. L. RAWLINS,

NASHVILLE, TENN.

An excellent device in the way of an air pump and receiver for ridding the freshly mounted slide of air bubbles, may be made after this fashion. The pump consists of an ordinary small bicycle pump which may be made to exhaust the air from a chamber by simply changing the working direction of the valve and turning the piston leather so that the convexity comes to the outside instead of the inside of the metal disc. A washer of somewhat smaller size than the disc must also be placed in front of it to keep it from collapsing.

The receiver is made by fitting two soft rubber stoppers into a glass tube of such length that the chamber left is of sufficient length to act as a receptacle for the slide, and of such width that the slide will easily go in. For want of something better a straight lamp chimney known as the students, may be cut with a file and ground down smooth.

Through one of the stoppers a small perforation may be made and a piece of brass tubing which has had a thread cut on it to correspond with the pump nozzle, is to be tightly fitted. With a leather washer to go between, the instrument is ready for use.

While it is an advantage that a stop cock be interposed to secure the vacuum for some time it is not indispensable.

Specimens for imbedding may be put into a short test tube and put in this chamber in order to be rapidly permeated with the thin celloidin solution.

The University of the State of New York has decided that after January 1, 1897, no degrees B. A. or A. B. shall be conferred *causa honoris*.

PRACTICAL SUGGESTIONS.

BY L. A. WILSON,

CLEVELAND, OHIO.

Phyllactinia Suffulta.—This is one of the largest and and most striking of the Family Erysipheæ. The genera Phyllactinia contains but one species. The species vary exceedingly on different host plants but are considered by experts to be variations of the same species.

They are found on leaves of the magnolia tribe, on elders, beech, oak, ash and many other plants. It is in fact a very common and ubiquitous species. It is a very interesting specimen, which is easily recognized by the appendage, being swollen into knobs at the base, with the tips straight. All the manipulation required for their display is to dip them from the leaf with a spatula, transfer to a glass slip into a drop of water, cover and examine.

They show well with a one inch objective. They may be mounted and preserved in glycerine jelly.

How to Save Money.—Dealers generally charge fifty cents a bottle for immersion fluid. An amateur recently concluded to save this outlay. He procured a formula from an eminent microscopist. He purchased the materials from a reliable chemist. The formula required the boiling of the materials. The product was designed to be homogeneous fluid. The amateur boiled the stuff in a nice clean porcelain dish over an alcohol lamp. While boiling some one arrested his attention and the hot stuff tipped over, scalded his hands, spoiled his new breeches and ruined a carpet. This should not discourage any one. He may save fifty cents next time.

Hypoxylon albocinctum.—This fungus is one of the very many species of a large genus. The manipulation of one will be the "open sesame" at all. Many have seen them but have passed them by as of no importance; yet they are complicated plants well worthy of an acquaintance.

Most of them are found on leaves, bark and twigs and

form black spots from a millimeter upward in size. The black spots are the stromas, which in this species are flat, carbonaceous and purplish black. In this species the fungus grows on *Crataegus*. The fruit is in the upper part of the stroma. Cut a small slice, transfer to water in a glass slip and mash fine with a spatula and cover.

Examine with a one fourth or one fifth objective. This will exhibit long cylindrical asci, with brown spores arranged in a uniseriate manner. The spores generally contain a round spore blast at each end.

Potassic Iodide for Preserving Infusoria.—The use of this medium is very simple and is said by Mr. W. S. Kent to act in a manner almost identical with osmic acid. For use, prepare a saturated solution of potassic iodide in distilled water. Saturate the solution with iodide, filter and dilute to a brown sherry color.

A very small portion, only, of the fluid is to be added to that containing the infusoria.

QUESTIONS ANSWERED.

NOTE.—Dr. S. G. Shanks, of Albany, N. Y., kindly consents to receive all sorts of questions relating to microscopy, whether asked by professionals or amateurs. Persons of all grades of experience, from the beginner upward, are welcome to the benefits of this department. The questions are numbered for future reference.

Q. 245.—Can you tell me if there is any book published giving Microscopic examinations for adulteration of food and medicine and where it may be procured and cost?
D. A. B.

A. Hassal, *Food, Its Adulterations, etc.*, \$8.75, published by Longmans, Green & Co., is the classical work; but the great bulk of more recent work is scattered through the files of the *American Analyst*, and the various microscopical and other technical journals.

Q. 246.—Are the fibro vascular bundles and tubes for the circulation of sap? In the sunflower there is only simple cellular tissue. How is circulation accomplished?
—Snohomist.

A. Sap circulates by preference through the fibrovascular bundles of a plant, but every living cell can absorb sap and transfer it to contiguous cells. The sunflower stem has a ring of fibrovascular bundles in the condensed tissue beneath the cuticle.

SCIENCE-GOSSIP.

The Change Produced in Meat by Freezing.—The character of the meat consumed nowadays has become a serious hygienic matter. In a pharmaceutical journal, published in Germany, a writer describes a simple process for distinguishing between fresh meat and that which has been preserved in the frozen state, viz., the expressing of a small quantity of blood or meat juice from the sample, and its examination under the microscope. The whole operation must be performed quickly, in order to prevent any drying up of the liquid under examination. When the juice of fresh flesh is thus examined, it is seen to contain numerous red corpuscles, which are normal in color and float in clear serum. But in the case of blood from frozen flesh the corpuscles have dissolved in the serum under the influence of the lower temperature, and not a single normal red corpuscle can be seen—the hæmoglobin escapes into the serum and appears as irregular yellow-brown crystals. These may be frequently seen by the naked eye, but in every case can be readily detected under the microscope.

Death After Antitoxin Explained.—A full and satisfactory explanation of the sudden and tragic death of the little son of Dr. Langerhaus immediately following an injection of antitoxic serum, has been reached through the subsequent investigation. In the first place, the analysis of the serum proved it to be reliable, and no irregularity in the method of its administration could be discovered. It was found, however, that the child had just completed an unusually heavy meal, and as the necropsy showed, his larynx and trachea well filled with a material identical with that

found in his stomach, the accepted inference is that while faint from the shock of the injection he was unable to eject the vomited matter from his throat, and instead drew it into the air-passages with fatal effect.

It may be concluded, then, that what appeared to be quite damaging evidence against the serum was really the result of a very simple accident.—*Medical News*.

Tuberculouc Cows Destroyed.—A report has been made by Chief inspector Martin upon the sanitary condition of all cows within the city limits, and the condition of the premises where they are kept. Below the Harlem there are one hundred and sixteen different locations, in which a total of three hundred and forty-three cows are stabled. Out of one hundred and fifty-three examinations made with a tuberculin test, twenty-eight tuberculous cows were found and destroyed. The post-mortem examination confirmed the test in every single instance. The health of a large number of persons has been in danger from the milk supplied from these sources, and it is sincerely to be desired that the work thus entered upon may be pursued until it becomes no longer possible for so many diseased animals to exist at any time, either within the city's limits or in herds from which the city's milk supply is drawn.

English Ice Cream.—Certain confectioners and restaurateurs have a way of advertising their ice cream of extra richness as Philadelphia or New York ice cream, and charging the credulous with an extra price for the same. But for real denseness of richness the ice-cream of our sister cities is not likely to reach the standard of real London ices.

Dr. MacFayden and Mr. Collyer have recently completed for the British Institute of Preventive Medicine an investigation into the nature and quality of the creams vended on the streets of London. "They report," says the Medical Record, "that ice cream has only 26.5 per cent of solids, the rest being water; that the solids consist of fats, four per cent, sugar, twelve per cent, starch, six per

cent, albuminoids, four per cent, and mineral matter, one half per cent. This all sounds well enough, and would lead the unwary reader to think that ice-cream was all right, but the denouement comes in the results of microscopical research. The microscope shows the presence, in London ice-cream at least, of bedbugs, bugs, legs, of fleas, straw, hair, coal, dust, woolen and linen fiber, tobacco, epithelial scales, and muscular tissue. Even the microscopical examination, however, is delectable compared with the results of bacteriological studies. These reveal in street-barrow ice-cream a maximum number of seven million microbes per cubic centimeter, while the shops have only one million per cubic centimeter. The character of the microorganisms is extremely mixed. There are the bacteria coli communis, besides spirillæ and putrefactive microbes of various kinds. We find no account of a chemical analysis, which would perhaps add the final touch to the pathological picture of the ice-cream of the shops."—*Boston Medical and Surgery Journal*.

PERSONALS.

Mr. R. E. Kerry, director of the bacteriological laboratory of the Vienna Veterinary Institute, died recently at the age of 34.

Dr. R. Meade Bolton, now bacteriologist of the Philadelphia Board of Health, has been elected instructor in bacteriology in the University of Missouri.

F. F. Jerisman, professor of hygiene in the University of Moscow, has been excluded, it is reported, from further service at the University, owing to his liberal views in political matters.

M. Francois Felix Tisserand, director of the Paris Observatory, died in Paris, October 20, at the age of fifty-one years.

CORRESPONDENCE.

Santa Barbara, California, Oct. 22, 1896.

An importer of Japanese goods occupying a store in the same building with me brings much of his goods wrapped in the grasses of the section where they are originally packed. Finding some which he assured me was from Nagoya in central Japan I made an infusion of it from which in three or four days I began to get infusorial forms which were familiar to me, amongst which some of which were of the following genera: viz: Colpidium (Schränk), Litonotus (Ehr), Oxytricha (Wzr.), Paramecium (Ehr), Euplotes (Stein).

In due time other familiar genera may be found. In the absence of text-books I cannot undertake to determine species.

There are many other forms amongst which there may be some that are new, but my literature in this department of natural history is too far away to avail me here.

P. L. HATCH.

Acknowledgement.—The cuts of the scale insect published in our last issue, were loaned to us by the Department of Agriculture through the kindness of Mr. L. O. Howard, the Entomologist. We regret that the acknowledgment did not accompany the publication.—*Chrysanthemum*.

Assistant Microscopist Wanted.—The United States civil service commission held an examination at the post offices in Boston, Mass., Indianapolis, Ind., and Chicago, Ill., on October 30 for the position of assistant microscopist. The salary of the position is \$600 per annum, and only women above the age of twenty were admitted to the examination. The subjects of the examination were as follows: Orthography, penmanship, copying, letter writing and arithmetic. It is desirable that applicants should have a knowledge of the use of the microscope.

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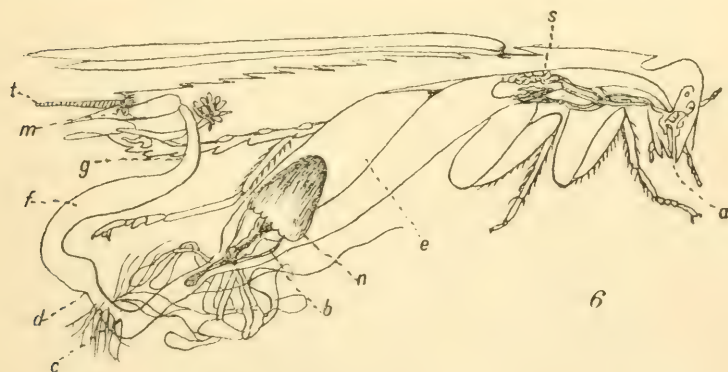
NEW SERIES

Objects Seen Under the Microscope.

By CHRYSANTHEMUM.

XXXVI.—THE COCKROACH (*Concluded*).

Passing from the complex arrangement of jaw appendages, consider the parts of the alimentary canal. To see these, the cockroach must be dried (with blotting paper) and its under surface imbedded in paraffin. The hard and soft wings must be removed, the terga or hard dorsal



sclerites cut through longitudinally on each side, and removed, care being taken not to injure the heart, lying immediately beneath them in the middle line of the back. Fig. 6 will now be of great use. It shows a dissection of the male cockroach looked at from the right side.

The three well known regions—fore, mid and hind intestine are present—but the first and third differ essentially from the second as to origin. Both of them

are formed by invagination from without, and are lined with chitin. The mid intestine is the primitive alimentary canal.

The fore intestine is called the stomodæum, a mouth. It consists (1) of a buccal cavity, from the posterior wall and side of which arises (2) the lingua or tongue (fig. 6, a); a large lobe lying on the median cleft in the labium; (3) the œsophagus shown at fig. 5, t; (4) the thin-walled crop (figs. 6, e and 7, e); (5) the thick-walled gizzard or proventriculus, meaning front little stomach (figs. 6, b and 7, b). This has six articular teeth and six elevations carrying setæ, on its inner surface.

The mid-intestine or mesenteron consists only of the true digestive chylic stomach (figs. 6, c and 7, c).

The hind-intestine is called proctodæum. It consists (1) of a short or narrow intestine (figs. 6, d and 7, d) sometimes called the ileum, (2) a larger or wide intestine (figs. 6, f and 7, f) called the colon; (3) a terminal straight portion or rectum (fig. 6, g).

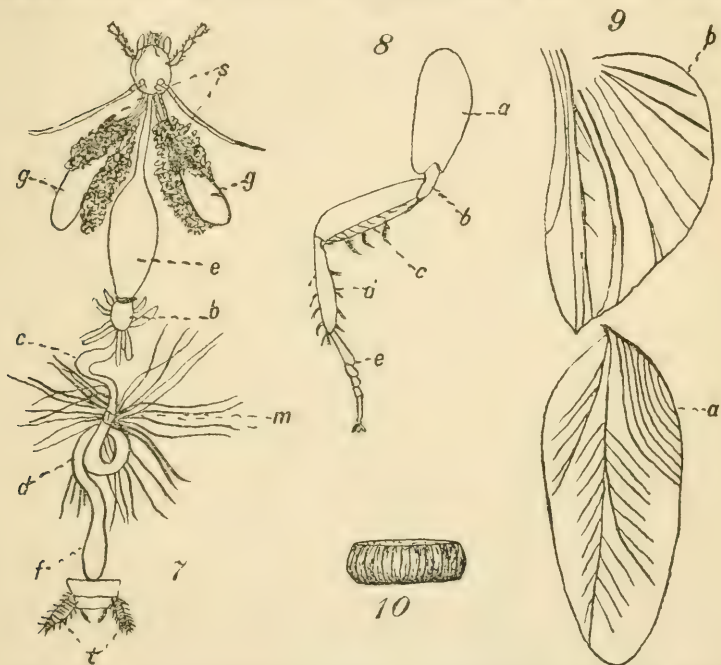
The median ventral posterior anus (fig. 7, m) is to be seen by raising the terga of the tenth or last abdominal somite with a forceps. Right and left of it are two small plates, the podical plates.

Fig. 6 shows the median, dorsal, chambered heart.

There are ten pairs of stigmata, spiracles, or breathing openings:—No. 1, at the bases of the first legs or between the prothorax and the mesothorax; No. 2, at the bases of the second legs or between the mesothorax and the metathorax; No. 3–10 between the terga and sterna of the first eight abdominal somites. The two thoracic and first abdominal stigmata can be seen by raising the wings. The other abdominal stigmata can be seen on looking at the ventral surface of the animal and stretching it slightly. Each stigma is at the apex of a little projection pointing backwards. The tracheæ, in structure, distribution, and functions are like those of the

honey-bee. Fig. 5, a, represents transverse sections of some of the head and neck trachæ.

The salivary gland (figs. 6, s and 7, s) is two lobed and branched. Fig. 7, represents the alimentary canal with its appendages of the cockroach, and is copied from Vol. V of the Cambridge Natural History. The glands are placed right and left of the crop (figs. 6 and 7). Their



ducts coming from each lobe on either side, join on each side and then those of the two sides join in the median line and open into the common duct of the salivary receptacles (fig. 9, g). Of these receptacles there are two and their ducts join in the median line and open into the buccal cavity.

The hepatic glands are eight cæca or blind tubes (figs. 6 and 7) attached to the alimentary canal hard by the junction of the gizzard (fig. 7, b) and the stomach (fig. 7, e).

The malpighian (kidney) glands (fig. 7, m) sixty or more in number are attached to the alimentary canal, hard by the junction of the stomach (fig. 7, c) and short intestine (fig. 7, d). The malpighian glands run through the fat body which surrounds the hind intestine.

To study the nervous system practically another specimen should be taken. It should be fixed by pins passed through the upper part of the epicranium, and between the mandibles. The clypeus and the front of the epicranium must be removed. The super-œsophageal ganglia or brain is supported by an internal skeleton of chitin. From its upper part are given off the optic nerves, and from its lower part, the nerves to the antennæ.

To see the succeeding parts of the nervous system, the head must be fixed upon its side and the genæ, mandibles first and second maxillæ removed. Then the circum-œsophageal commissure is shown in fig. 5 as two dots just below the œsophagus. From this, nerves go to the labrum. As usual, the two cords running from the brain one on each side of the œsophagus, end below in a large sub-œsophageal mass that supplies the mandibles, maxillæ and labrum, and, of course, belongs to the head.

To see the succeeding parts, place the cockroach back uppermost, remove the whole of the alimentary canal from gizzard to rectum inclusive, and turn aside the crop. The thoracic and abdominal chain of ganglia is thus exposed. The thoracic are three pairs, and supply the limbs. The abdominal are six pairs, connected by double cords, and supply the abdominal organs and the integument. The sixth represents the nervous centers of the sixth to tenth somites of the abdomen.

The visceral or sympathetic system is represented by a nerve given off from the circum-œsophageal commissure, and supplying the labrum and a frontal ganglion. From this frontal ganglion a recurrent nerve passes over the

outer surface of the œsophagus to a ganglion lying in the crop and giving off two branches.

The sense organs are the maxillary palpi, the labial palpi, the antennæ, and perhaps the oval cerci. The antennæ consist of three basal joints and 92 others.

The pale membranous patches or fenestræ, (fig. 4, c) near the eyes and the bases of the antennæ, are regarded as remnants of the simple eyes or ocelli. The true eyes (fig. 4, b) are large, black, reniform, compound, with many hexagonal facets and were described in the article on the honey-bee (Nov. 1895). It is probable that each of those long ocelli or cones enables the insect to see the particular part of the object commanded by that particular cone, and the vision of the insect is peicemeal, or what is known as mosaic vision.

The cockroaches run or get about at great speed. Their legs adapted for running, are three pairs, attached respectively to the pro-meso-meta-thorax. The legs are much alike. The joints, reckoning from the body out, are the coxa (fig. 8, a); trochanter, (fig. 8, b), femur (fig. 8, c), tibia (fig. 8, d), tarsus (fig. 8, e). The coxa are large and cover the three thoracic sterna and the base of the abdomen. On the femur and tibia are spines. The tarsus has five joints, the fifth of which ends in two claws. The male cockroach has two styles on the hind margin of the ventral aspect of the ninth abdominal somite. Also, he has the anal cerci, which are attached to the edge of the side of the tenth abdominal somite, and have many joints.

The two pairs of wings are attached to the meso-meta-thorax. The front meso-thoracic pair (fig. 9, a) are small and hard and called elytras or tegmina. They arise from the front corners of the terga of the meso-thorax, are made up of cuticle and skin. The wings (fig. 9, b) arise from the anterior corners of the terga of the meso-thorax and meta thorax, are membranous, and traversed by trachæ.

Cockroaches are unisexual. The male and female differ slightly. The male has two styles (figs. 6 and 7, t) attached to the ventral hind margin of the ninth abdominal somite. The female appendages are boat-shaped and are attached to the seventh somite.

The female develops egg capsules each of which carries sixteen eggs (fig. 10). These oblong capsules are carried by the mother and ultimately layed by her. The young then emerge and are helped out of the egg and of the capsules by the mother.

The cockroach and its allies do not undergo that metamorphosis which is generally characteristic of insects. The larva or young only differ from the adult by being paler in color and having no wings. It undergoes from five to seven sheddings of the skin. At last ecdysis or skin shedding of the wings appears.

The facts contained in this article are from Edward Aveling's article in the English Mechanic.

The Preparation of Diphtheria Antitoxic Serum.

BY H. K. MULFORD.

The discovery of diphtheria antitoxin was made by Behring, as a result of his primary and original investigation in connection with Kitasato upon tetanus antitoxin.

The method of preparation first proposed was the injection into suitable animals of cultures of the diphtheria bacillus in which the bacilli had been killed by heat. When the animal could stand these and manifest only a slight irritation or oedema at the point of injection or by showing only feeble temperature reaction, highly attenuated living cultures were introduced in increasing amounts, a sufficient immunization or resistance being given by the primary injection to prevent fatal termination. The injection of living cultures, however, are

* Read at Montreal before the A. Ph. A.

greatly to be discouraged, since such injections, and those of attenuated cultures containing dead bacilli, and accompanied by great destruction of the cellular tissues of the animal which is to furnish the antitoxin, its physical strength being greatly lessened by such destructive processes.

The method is as follows: As virulent a culture of the bacillus diphtheriae is obtained as possible, it is grown upon Loeffler's solidified blood mixture consisting of:—

Blood serum.....	3 parts
1 per cent glucose boullion.....	1 part

and placed in an incubator at a temperature of 45 degrees centigrade.

After a period of 24 hours the cultures are developed. From this a single colony of the bacilli is transferred into small flasks of a two per cent peptone boullion, rendered decidedly alkaline to litmus. These small flasks are placed in an incubator, which is kept in a constant temperature of 37 degrees C. for 24 to 48 hours, and afterwards the contents are transferred with a pipette into rounded flat flasks, of a capacity of 500 cc. These large flasks are placed in an incubator, and kept at a constant temperature of 37 degrees C. until the bacilli have become very numerous, and have secreted enormous amount of active and powerful toxin in the boullion.

When this has taken place a microscopic examination is made, to see that no foreign bacilli are present and the diphtheria toxin contaminated. If uncontaminated, 1 per cent trikresol is added to prevent contamination, and to destroy the bacillus diphtheria. The boullion, or as we now term it, diphtheria toxin, is filtered through a modified Chamberland filter, to separate it from the dead bodies of the diphtheria bacilli. No bacilli are therefore injected into the animals to be immunized, and they are not given "diphtheria" but the toxin secreted by the bacilli.

The toxicity of the toxin is determined by its injection into guinea pigs, and to be of a desired strength, 0.01-0.1 cc. should produce death of the control animal in from 24 to 36 hours.

For the preparation of diphtheria antitoxin any animal may be selected, but horses are preferred, inasmuch as they are more easily operated upon, and because they furnish excellent serum in liberal quantities. Our experience, as to the type of horse selected, particularly in the earlier observations has been valuable, being of unusually good quality, a number showing trace of fine breeding; such horses however, are not suited for immunization, the finely bred horse being sensitive, frets at his inactivity (for no work is performed by the animal while being immunized, only a sufficient amount of exercise being given to maintain good health) neither does he take kindly to the injection of the toxin, or the subsequent bleeding operations. The preference is given to large, compactly built animals of dark color, 16 to 18 hands high, from 1400 to 1600 pounds weight, of quiet disposition and in good health.

Before injecting with toxin, the mallein test for glanders, and the tuberculin test for tuberculosis is applied, the results of such being clearly shown in the temperature, which is carefully recorded. Animals responding to either of these tests must be discarded.

The primary injection of the toxin is 1 cc. and in equal periods of from six to eight days, constantly increasing amounts of the toxin are administered until in about ten weeks to three months, as great quantities as 300 cc. of this powerful toxin may be borne with tolerance. When the injection of these larger amounts is accompanied with but little elevation of temperature, and but a slight oedema is manifested at site of injection, a trial bleeding of 20 cc. of blood is made, the blood always being taken from the jugular vein. If the tests for antitoxic value,

as described later under the testing of antitoxin, are favorable, the horse is bled a large quantity, the blood being collected in sterile bottles, and placed in a refrigerating room for a sufficient time (about 24 hours) until the coagulation allows the clear serum, which contains the antitoxin, to separate. This serum is drawn off by pipettes and preserved by the addition of 0.5 per cent trik-resol.

The most important step now awaits the operator, the determination of the exact strength possessed by the antitoxin, as expressed in immunizing units.

For this purpose the minimum fatal dose of a strong toxin is accurately determined by the injection of various amounts into a number of guinea pigs; the smallest amount of toxin that invariably causes death of the animal in a reasonable time being regarded as the minimum fatal dose. It is usually calculated, so much per 100 grams body weight.

A page from the laboratory record shows this determination of strength, having found the minimum fatal dose of the toxin used to be .005 per 100 gram guinea pig, the control animals are given ten times this absolutely fatal dose of diphtheria toxin, per 100 grams weight and if testing for 100 units per ccm. as appears from experiment on control animal 1080, 1-1000 ccm. antitoxin obtained from horse 109 II is given. If testing for 250 units per ccm. 1-2500 ccm. of antitoxin would be given; if for 500 units 1-5000 ccm. of antitoxin would be administered.

Tests for 500 units are shown on control animal 1070, for 350 units on control animal 1076.

While this paper does not deal with the therapeutic value of diphtheria antitoxin, the absolute scientific value and correctness of these tests may be appreciated by the observations, and we prove the application of the antitoxin by its neutralizing or protective value upon the animals receiving ten times the absolutely fatal amount of

oxin. Unfortunately we cannot arrive at the exact dose for therapeutic application by this method, since the human subject is much more susceptible to the poison than the guinea pig, and we have no possible means of determining the amount of toxin secreted by the diphtheria bacilli in the patient suffering with diphtheria; therefore if any error in amount of antitoxin administered is made, it should be its administration in excessive rather than in an insufficient quantity.

Appreciating however, that the effect of diphtheria antitoxin is only in neutralizing the toxin of diphtheria, we know how necessary it is to make application of this "healing serum" before the nerve centres become paralyzed; the heart and kidneys become diseased and the entire system invaded by the absorption of the fatal toxin.

Diphtheria antitoxin is a most delicate substance, and its preparation can only be safely carried on in thoroughly equipped institutions, where men of undoubted integrity and ability are in supervision.

While antitoxin is a delicate substance, yet, when a proper preservative in a sufficient amount is used, and it is hermetically sealed in sterile vials, it will preserve its strength and antitoxic value for at least six months; indeed repeated experiments prove that it retains its activity for a much longer period.

Antitoxin is usually supplied in bottles containing varying quantities of serum, but of a certain number of immunizing units. This is apt to lead to confusion, and we would strongly recommend that a fixed standard of a definite number of immunizing units be secured in each cc. of serum. While this involves extra labor, it prevents confusion on the part of the physician, and the end is well worthy of the increased labor. If serum is produced of a strength of 125 units per cc. the result is that each cc. will contain 100 immunizing units, and if it is de-

sired that 600 units are to be administered, 5 cc. will be understood as the amount to be injected, etc.

It is a matter of gratifying interest to Americans, that serums of the highest antitoxic values have been prepared in our own country. Serums are now produced in which each cc. contains as much as 800 units, and we confidently believe as great an amount of antitoxic units as 1000 to the cc. will be produced in the near future. This overcomes the chief objection that has been urged against the serum, even by its warmest advocates—more prompt absorption will take place, ensuring quicker results, besides the attendant dread caused by the large instruments necessary for the introduction of large amounts of weaker serums will be avoided: 2000 units may thus be administered in an ordinary hypodermatic syringe.

Dried serums are much less active than fluid or fresh ones. They are prepared by the addition of aluminium or ammonium sulphate, with subsequent precipitations of the antitoxin by a one per cent soda solution, or by inspissation. They have given fairly good results, but cause greater irritation than do fluid serums, and not being freely soluble cause annoyance in administration, and give greater opportunities for contamination in their preparation and in the dilution for administration.

The accepted theory of the action of antitoxin, is that it renders the living cells of the organism tolerant to the toxin liberated by the diphtheria bacilli, and by increasing this tolerance they are able to overcome these toxins.

That antitoxin exerts no chemie action on the toxin can be proved by mixing toxics and antitoxins maintaining the mixture at a temperature of 70 C. At this temperature the antitoxin is destroyed, while the toxin remains but slightly disturbed in virulence.—Registered Pharmacist.

The Academy of Medicine, Paris, France, offers a prize of \$160,000 to him who will discover a specific for phthisis.

PRACTICAL SUGGESTIONS.

BY L. A. WILLSON,

CLEVELAND, OHIO.

How to Manipulate Lichens.—Many amateurs look at a few stock slides and then tire of the microscope. However, the field for investigation is boundless and so extensive that no individual scientist can become great or thorough in more than one field. Lichens have been explored by many pioneers but they are still upon the confines of science and have been investigated by the few-and-far-between. This neglect is largely owing to the fact that some of the most prominent authors on the microscope dismiss lichens with the statement that no one but the advanced manipulator can deal with them. This idea is entirely erroneous. The merest tyro can easily manipulate them satisfactorily and demonstrate their hidden structure.

By macerating the thallus or the apothecia while soaked in a drop of potassium hydrate on a glass slip, covering and filling the cover with water, the whole structure may be displayed and examined.

Then the spores may be easily measured and the reactions of different specimens with iodine may be observed. Many species have remarkable and beautiful spores.

To Him That Hath It Shall Be Given.—In studying any subject or branch of science it is much easier to learn the properties of a single specimen by having a large collection of various specimens of the things under examination. This applies to hair, plants, textile fabrics, blood, food adulteration and in fact almost universally. It is impossible to compare objects and see their resemblances or differences unless you have the objects to set in juxtaposition.

No Excess of Balsam is Necessary.—In mounting, the observance of a little care, will obviate the necessity of any surplus of balsam. A little practice will effect the desired end. Place the balsam in the center of the slide

and cover. Then heat until the fluid flows and fills the space under the cover. Use a little less balsam than seems necessary. A little pressure on the cover will spread the balsam to the edge.

How to Obtain Paste Eels.—Paste eels are undoubtedly fattened vinegar eels. These objects are always interesting to exhibit to friends. It is not as easy to procure them from the limpid vinegar as from the thicker paste. In the vinegar they are too active and dart too rapidly from the field; in the paste they become fat, large and sluggish and remain in the field. For their production, make some boiled flour paste; add to this a few drops of cider vinegar and in a few days the paste will teem with the eels. Be sure that the added vinegar contains eels; to do this, hold the vinegar cruet between yourself and a strong light and examine with a pocket lens. In the drops of vinegar added to the paste, secure as many eels as possible. Keep the supply in an uncorked, open-mouthed bottle with as broad a base as possible.

SCIENCE-GOSSIP.

How Roquefort Cheese is Made.—It is supposed that hundreds of years ago the South of France was disturbed by volcanic eruptions, which slit up the ancient granite rock causing streams of lava to flow from them. The new surface consists of basaltic rock, which in its turn was fissured by eruptions and thrown up on a mountain range. The whole of the interior of a mountain was thus formed into caverns and caves, which belch forth hot sulphurous springs. It is here that the celebrated Roquefort cheeses are made. The village of Roquefort is situated on the Mountain Larzac, which is about twenty-five miles in length and nearly 3,000 ft high. It consists chiefly of limestone, covered with sufficient pasture to feed the 300,000 sheep kept for their milk. The caves, being formed by the displacement of rocks, consist of an intricate laby-

rinth of open spaces and passages connected with each other and with a subterranean outlet. A cool current of air, therefore, always of the same humidity and temperature, flows in a never-interrupted stream through the caves. There is nothing in the milk or in the preparation of the cheeses that give them that peculiar flavor and delicious mellowness for which they are so renowned. This is entirely effected by the method by which they are cured. When the cheeses are ready for treatment they are taken to the caves, and after being allowed to cool are carried to the salting room. They are rubbed with salt on one face and then piled on the top of each other until the cave is full. After standing twenty-four hours or so, the reversed side is salted, and once more they are piled up as before. The cheeses have to be frequently reversed, in order that the moisture may be even throughout, and to develop the fungus which has previously been sown in the curd. In forty-eight hours the cheeses become viscous, and are rubbed with a coarse cloth. In the course of another two days the fungus will appear on the outside, in the form of a sticky paste. This is carefully scraped off with knives, together with a thin stratum of crust, and set aside for food. The cheeses are now sorted out; the most solid ones placed on the floor. In eight days' time they become covered with a yellowish red mould, together with other minute vegetation, which is removed and given to the pigs. The scraping is continued until the character of the mould changes, showing that the curd has altered its condition, and announcing its completion of the cure. Then they are again carefully scraped and wiped, and wrapped in tin foil, and are ready for the market. Roquefort cheeses have been cured for centuries by this process, and stand as a triumph of uneducated art.—Commercial Gazette.

A Giant Lens.—The largest telescopic lens in the world is now completed. It is the great refractor made by Alvan Clark of Cambridge for the Chicago University; and it will be used at the University's new observatory, now in process of completion at Lake Geneva, on the Wisconsin side

of the northern border of Illinois and about seventy-five miles northwest of Chicago. The air there is free from Chicago's smoke.

The object-glass is within a fraction of 42 inches in diameter—being exactly $41\frac{3}{8}$ inches. The great objective of the Lick observatory—the next largest one—was made by Alvan Clark, the father of the present telescope-maker, and is 36 inches in diameter. The tube, or focal distance, in the Lick telescope is 57 feet. This new and still bigger glass is to have a tube 61 feet long. It is now being finished by Warner & Swasey, at Cleveland, Ohio, who will mount the instrument equatorially, and who have already made the ring for the objective. In this great refracting glass the sheet of crown glass is 3 inches thick at the middle, $1\frac{1}{4}$ inches thick at edges, and weighs 205 pounds; while the flint glass weighs 301 pounds making 506 pounds for the objective irrespective of the ring. The whole will weigh about 1,000 pounds, and it may be a problem to keep the big glass from bending, after all.

The cost of this giant lens is over \$100,000. Its raw material (which cost \$40,000 in Paris) was repeatedly melted by Mr. Clark, for the sake of purity and perfection. It has taken two and a half years to make this big object-glass.

The elaborate work of packing this precious product, for transportation to Lake Geneva, Wis., will be careful and costly. First it will be tightly wrapped and sewed up in flannel; then thickly covered with layers of soft paper; then wrapped in hard paper, and the whole encased in a bed of curled hair in a strong box. This, placed within a larger box and mounted upon springs, on all sides of the inner box, and packed in excelsior, will rest in the middle of an easy going parlor car, and four men will go with the precious freight, which may be destined to reveal interesting things concerning "other worlds than ours."

Prof. Koch has been sent to South Africa by the German government to investigate the causes of the Rinderpest.

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